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ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

Thirty-six-inch Planer.

The illustration on this page is of a new planer recently brought out by the Lodge & Davis Machine Tool Co., Cincinnati, Ohio, the cut being made from the 36-inch size, though two other sizes—24 inches and 32 inches—are made from the same design. It will be noticed that the bed of the machine is of unusual depth to secure rigidity, and it is cross-webbed inside at intervals of about 24 inches, the entire depth.

The platen, which is also made unusually deep, is scraped to a bearing upon the bed, and slides upon Vs which present large bearing surfaces with special provision for thorough lubrication. Extra holes are provided at the end of the bed, through which bolts can be passed for securing extra long work.

The uprights, as will be perceived, are deep, of a form best adapted to resist stresses, and broad on the face to which the rail is secured. The rail on the 36-inch machine, is made of extra length, so that the second head may be used, and run out of the way, when not in use. The rail is raised and lowered either by power or by hand, as may be most convenient.

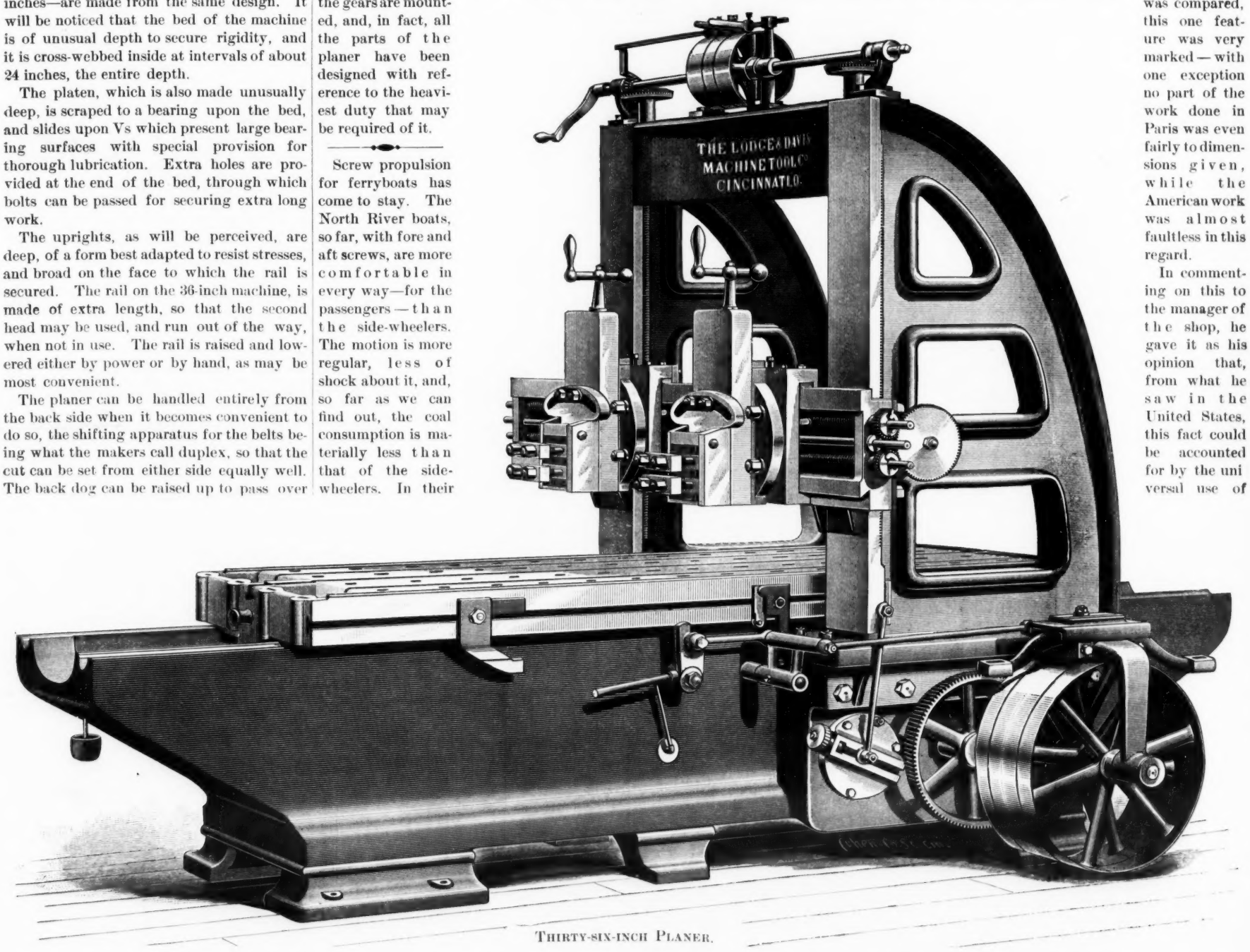
The planer can be handled entirely from the back side when it becomes convenient to do so, the shifting apparatus for the belts being what the makers call duplex, so that the cut can be set from either side equally well. The back dog can be raised up to pass over the shifting lever, so that the bed may be run forward for examination or measurement of work.

The belts, which have a ratio of speed to that of the platen of 60 to 1, are shifted alternately, and give a backing speed of about 4 to 1.

Special pains are taken to secure the best and most quiet running gears, and they are made so that they can be duplicated at any time. The shafts upon which they are mounted are supported in bearings made by boring through the bed, the boxes being of such form, and so secured in place, that any shaft with all its appurtenances can be removed bodily from its position should it become necessary to take the machine apart. The bearings are also easily renewed when worn, and are solidly supported by the bed their entire length.

All feed pinions and screws are of steel. Each machine is provided with the device for holding bolts illustrated in our issue of November 14, 1889.

The gears, racks, shafts upon which the gears are mounted, and, in fact, all the parts of the planer have been designed with reference to the heaviest duty that may be required of it.



THIRTY-SIX-INCH PLANER.

Screw propulsion for ferryboats has come to stay. The North River boats, so far, with fore and aft screws, are more comfortable in every way—for the passengers—than the side-wheelers. The motion is more regular, less of shock about it, and, so far as we can find out, the coal consumption is materially less than that of the side-wheelers. In their working, more account is taken of the gain from expansion, and the turning is made more even. It looks as though the day of the paddle-wheel had gone by. It served its purpose excellently, and was naturally the best thing in its day. But the more scientific screw will supplant it on the short ferry, just as it has on the trans-Atlantic ferry.

One of the most noteworthy changes in the price of supplies is that made by the Pittsburgh Reduction Company in the price of aluminum, the change being to $1 per pound. At this price, undoubtedly aluminum will be used for many purposes for which German silver and nickel are now used, its lightness being quite in its favor.

European vs. American Shop Methods.

BY W. D. FORBES.

Some time ago the writer was obliged to go to Europe for engineering reasons, and during a six months stay had quite an amount of machine work done in various shops, mostly in Paris. It was a city well-known to him in the early seventies, and the shops of the Continent and their methods were far from being novelties to him; but, notwithstanding this familiarity, surprise must be the word which expressed his feelings on renewing his acquaintance with them.

It is not a good plan to point out the faults of others when we are full of them ourselves, unless by so doing we become better aware of what we lack, and attempt corrections, and in this spirit the following is written, and in the belief that not a few of the faults mentioned are those of many shops of the United States. The work to be done was required at once, and a full set of very clear drawings were in readiness, as was also a sample in every way correct, except as to size, which had to be augmented about one-third.

When the work was finished its cost in Paris was almost to a cent double what it cost here, and the time taken to do it was more than double. When the workmanship was compared, this one feature was very marked—with one exception no part of the work done in Paris was even fairly to dimensions given, while the American work was almost faultless in this regard.

In commenting on this to the manager of the shop, he gave it as his opinion that, from what he saw in the United States, this fact could be accounted for by the universal use of the micrometers and "snap gauges," while in France their use was a great exception. When asked where a fine set of metric gauges could be obtained, he said he could not tell me, but would give the writer an address in a day or two, as he had a friend who had just been looking up the subject, and he would find out from him. In a few days the information came, with a note stating that the address given was one where by far the best metric gauges could be obtained, and at a price which, considering the work, was astonishing. This was the address: Brown & Sharpe, Providence, North America.

Now, what was the reason of work in France costing more than here? Wages would not explain it, as the difference is not

very great, first-class tool makers or machinists obtaining from twelve to fifteen francs—$2.40 to $3.00 per day.

When the shop was inspected the reason became clear—it was almost entirely due to poor equipment.

There were some very good machines, well handled, but handicapped by not being furnished with proper tools and means to keep them in order. As for makeshifts, their name was legion—it really seemed that everything about the place was a makeshift.

A Brown & Sharpe miller, which, it was stated, was bought in the sixties, was being used to drill straps for the planer, the planer was being used to draw down some wire, bolt heads were being filed to size, and so on all through.

It is the grand exception to see a really well-equipped shop anywhere. An extended tour in this country showed the writer some very fine, and, it might be said, perfect shops, but it was only where the shops were very large. It would not take but a few hours from New York city to enter a shop which turns out work amounting to hundreds of thousands of dollars a year, yet in it anything above two inches in diameter is cut off under a hammer. In another shop there is not a drill chuck of any kind for small drills, or a universal lathe chuck.

Let us illustrate what a well equipped shop means to the customer, by a case known to the writer.

A man came into a shop and laid a piece of three-quarter round machinery steel, three feet long, on the foreman's bench. The foreman shook his head after a few moments' conversation, and called several of the men up to question about doing the job. At noon the bar still lay on the bench, and was the subject of conversation. The foreman said the job could not be done; some one asked what it was, and the reply was that a three-eighth hole, perfectly straight, smooth and true, was wanted through the bar. The writer thought with the foreman that it was out of the question.

A young fellow under instructions took a look at the bar, filed it a little on one end, and asked what it was worth to do the job. With great contempt the foreman answered, "Twenty-five dollars; do you want to take it?" "Yes," the young fellow said, "if he was sure of his money." He was marched into the office, and, in a few minutes, came out, took the bar, put on his coat and hat, and left, we supposed, forever.

Next day, at noon, he came in and laid something down, wrapped up in paper, on the foreman's bench. We all drew around, and, after the paper was taken off, there in the bar was a three-eighth hole, straight, true and smooth, all through it; and, ten minutes afterward, we all had cigars out of the twenty-five dollars.

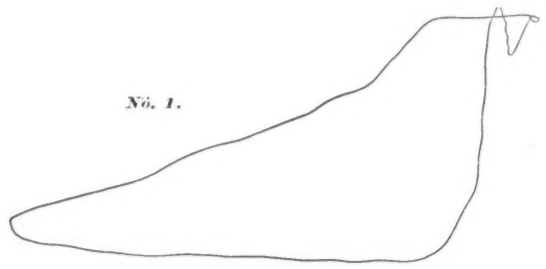
When the owner came in and saw the work, he wanted to give a contract at once for fifty at the same price, but the young man said that he had made all that was fair out of him, and further told him to take the work to any manufacturer of rifles, and the work would not cost over two dollars.

The recollection of this incident brought up the question whether the writer had taken his work to the right shop, so he started to investigate, with the result of finding that no better place could have been selected.

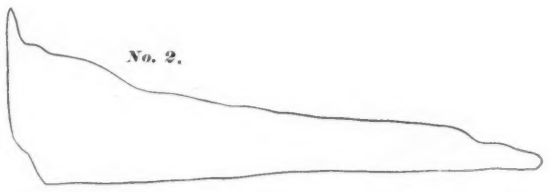
As most of your readers know, foreign shops are not as easily entered as ours, a more positive method being employed to keep strangers out than our usual "No admittance" system, and it is fair to say that their way is the better, not that it is well to keep a shop absolutely exclusive, but that it is well to know just who goes into your place of business, and, if possible, why he wishes to go.

There was very little trouble to get permission to enter shops, and very little to see after getting in. One thing, however, was noticeable—the floors were kept clean, and some system of tool keeping was always found to be well carried out.

One part of the work being done for the writer required to be knurled, about as we are used to see gauge handles. A two days' hunt through Paris failed to find the necessary tool to do this work, and it was produced on a universal milling machine at a cost absurdly large.



Dia. 3 5/16 × 4" Scale 60



Dia. 4½ × 4" Scale 60

Dia. 6½ × 4" Scale 30
Steam 100 lbs.
Revs. 450.
Henderson Engine 7 H.P.

There seemed to be a feeling among the workmen and overseers that a milling cutter was an article best kept in order by not being used; there seemed to be danger of a panic when one was to be sharpened, and, considering the tool on which it was generally done, it is not to be wondered at. Even when a first-class grinder was at hand the speed of the wheel was so slow that good work could not have been hoped for. One cutter grinder was built so that the wheel was mounted on the end of an arbor about ¾ of an inch in diameter, and the cutter was stationary, and the wheel run over it. When a three-inch cutter was to be ground on this rig a panic was excusable.

In one shop a lot of sights for large guns were being made out of composition; the general form was like the letter T, a slot being in the cross-piece in which was to be moved, by a screw, a block carrying the sight; the stem was a parallelogram, and graduated. The first operation was to rough them all off on a planer, the speed of which was about right for unannealed steel, and when they were taken off the surface was quite as rough as the casting, the only gain being a truer general surface. No machine work was done on the edges, but a file brought the metal down to its size, and worked out the slot in the crosshead. Yet when these sights were finished they were handsome pieces of work, and, no doubt, did all the work that was required of them, but their cost was fully twice as great as if made in a well-equipped shop here. If any one thing is noticeable in the handling of machine tools in foreign countries it is their speed. It is bad enough here, many of us know, but where we run eighteen and twenty feet per minute, they do not run eight or ten. The lack of handy chucks, etc., is well known, but, allowing that they were at hand, the writer was not able to see that the tools on which they could be used were so designed as to allow the results expected and obtained here.

Du Bois & Du Bois, of Washington, D. C., have issued a pamphlet which is called "The March of Invention." It contains a good deal of information regarding patents, and a number of illustrations designed to show the improvements which have been made in various lines of work. Many interesting things, as well as much information of use to inventors, will be found within its covers, and we understand it will be sent to those who apply for it.

The January number of *Mechanical Progress*, which is published by Richards & Co., the well-known machine tool manufacturers, Broadheath, England, comes to us greatly improved in every way, though it was a good mechanical paper before. Its cover is now japanned and printed in gold, and the paper and press-work are of the highest character. Mr. George H. Richards has himself assumed the editorship, and has banished the editorial "we." The complaint has been quite general among English manufacturers, that they could not get as good illustrations made, nor as good press-work for trade catalogues as seemed to be the regular practice in this country. The appearance of *Mechanical Progress* would seem to indicate that this difficulty has been, in a measure at least, overcome.

The Henderson Triple-expansion Engine.

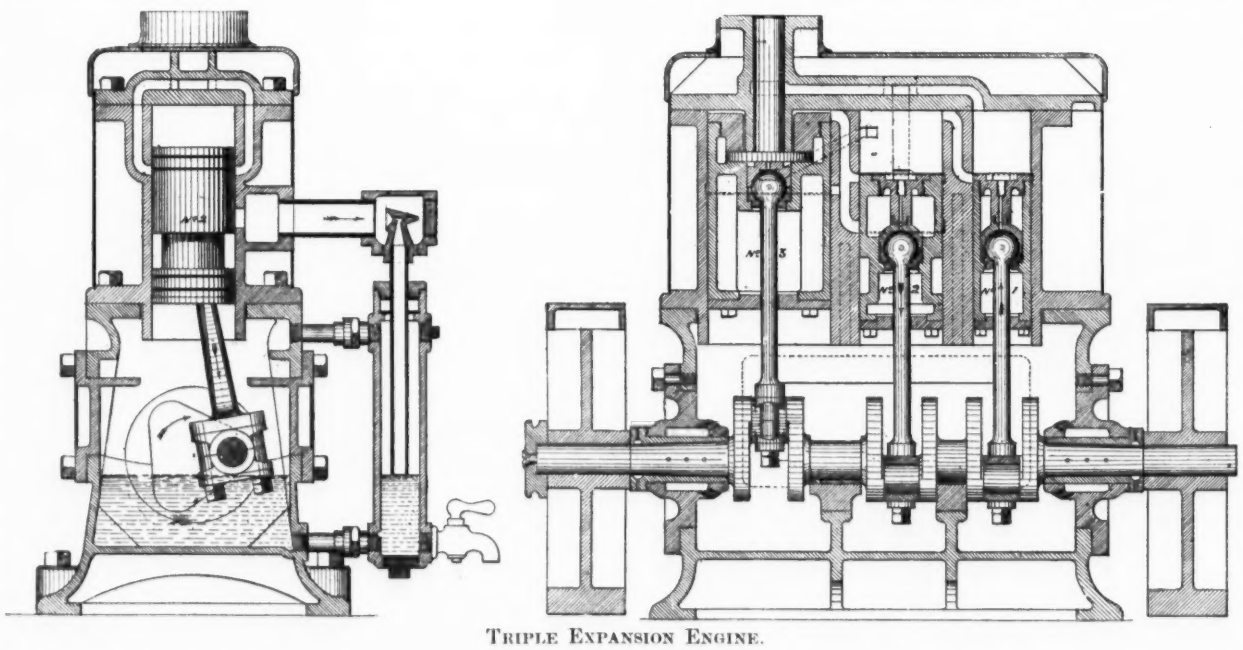
We show with this some diagrams from a small triple-expansion engine, which has been patented by W. M. Henderson, 4420 Chestnut street, Philadelphia. These diagrams will, we think, interest our readers, not only as being taken from a triple-expansion engine, but particularly as being taken from such small cylinders. While with large cylinders the mechanical world has been forced to admit the economical utility of compound engines, it has not been thought that economy could come from so small motors as those indicated in this.

In this engine the moving parts are reduced to the lowest practicable limit, the pistons of two of them being extended and so formed as to provide for the steam distribution, leaving practically little but the connections and the cranks.

Three single-acting cylinders are mounted on a crank case. These cylinders we may, for convenience of description, denominate as 1, 2 and 3. Piston 2 is twice the area of 1, and 3 is twice the area of 1. The low-pressure piston 3 actuates a piston valve which actuates steam to 1, then the distribution is further made by the several pistons.

Side thrust of the pistons is provided against by the well-known practice of providing false balance ports

Taking the diagrams as they go, we think they will be considered as excellent from an engine where something must be sacrificed to bringing about simplicity of operation. The area presented by this valve, always under initial steam pressure, besides steadying piston 3 on its up stroke as a cushion, has the effect of equalizing the pressure on the pistons, reducing the effective pressure on the high-pressure piston, the more powerful, and aiding the low, the less powerful. This piston valve is arranged to cut off the steam at two-thirds stroke, making, with the difference in areas between the first and last cylinders, a steam expansion of about five times. An inspection of the drawing clearly shows how the steam is passed on to cylinder No. 2 by the piston of No. 1 acting as its valve, the piston of No. 2 acting in like manner as a valve for cylinder No. 3. The connecting steam port has two openings, the lower one made to coincide with a circular groove on the body of the intermediate piston, the two matching, at the proper time, for exhaust, when piston 3 has about reached the end of its stroke. The last effort of the exhausting steam is made to free the crank case from heated vapors, and maintain a constant fluid level by the ejector and dip pipe device, the action of which will be readily understood.



TRIPLE EXPANSION ENGINE.

In the position occupied by the pistons in the illustration, it will be seen that piston 1 has completed its stroke, and, in ascending, has just closed the steam port leading to cylinder No. 2. Compression would begin in cylinder No. 1 from this point, but for the fact that another avenue is opened for the

expanding steam to continue its flow, by means of side ports. When piston 1 has reached the point shown, piston 2 then descending, it will be seen, has already uncovered the upper edge of these secondary ports (shown in duplicate on the cross-section), and so the flow of steam from cylinder No. 1 to cylinder No. 2 proceeds uninterrupted.

Another set of side ports connects cylinder No. 2 with cylinder No. 3 for the same purpose, and operates in the same manner. But it will be observed that the opening in cylinder No. 2 is some distance down from the head. The piston passing over these openings entraps some steam, to afford a necessary cushion. This piston, unlike pistons 1 and 3, not being provided with down thrust, No. 1 always having the back pressure from No. 2 on it, and No. 3, as before pointed out, always having the initial steam pressure bearing on the small piston valve carried by it.

The triangular form of crank is truly balanced, because the center of motion coincides with the center of gravity, just as a disk crank would be, but it possesses the double advantage of being lighter, and more readily placed in running position. It will be seen at a glance that the relative position of the crank-pin centers are just where the respective centers of eccentrics should be to admit steam to the next following piston. Taking advantage of this hint, it will be seen how easy each piston may be made to serve as a valve for its neighbor.

Side thrust: The several pistons are relieved from side thrust by simply casting, opposite each port, a recessed impression of the same, and joining the two by a small pressure duct, thus maintaining a constant equilibrium on all sides of the piston—a matter of vital importance in engines of this kind, where the pistons pass over open ports.

Cover plates are attached to the lower ends of all the trunk pistons, each having a slot to allow only for the vibration of the connecting rod, preventing the liquid contents of the case from splashing into the hollow pistons, wastefully condensing the working steam, and unnecessarily heating the lubricant and journals.

The upper ends of the connecting rods being now shut off from any chance of meeting with lubrication from below, in consequence of the cover plates, some other means must be adopted to keep them oiled, and this is done by making ball and socket joints to the upper ends of the rods, in lieu of crosshead pins. A small hole is drilled to each from above. Unfailing lubrication is maintained by the condensed steam, mixed with whatever lubricant is used on the pistons.

Journal lubrication is insured from within, and no oil cups are used on the engine. The cast-iron heads at the journals are cast with a hollow, through which bronze sleeves ar introduced. Oil holes are drilled through the sleeves, communicating with the hollow part, which again have larger holes communicating with the interior of the case. The hollow space is filled with lampwick, to prevent swashing.

One of the most difficult things in engines of this class is to get the crosshead pin precisely parallel with the crank pin. Thumping of the rod, and abrasion of the pin, are matters hardly avoidable. By using a ball joint, it is of little consequence whether the cylinders are precisely at right angles to the crank-shaft or not. The pistons will pursue the path of the bored cylinders, whatever it may be, with entire freedom from binding.

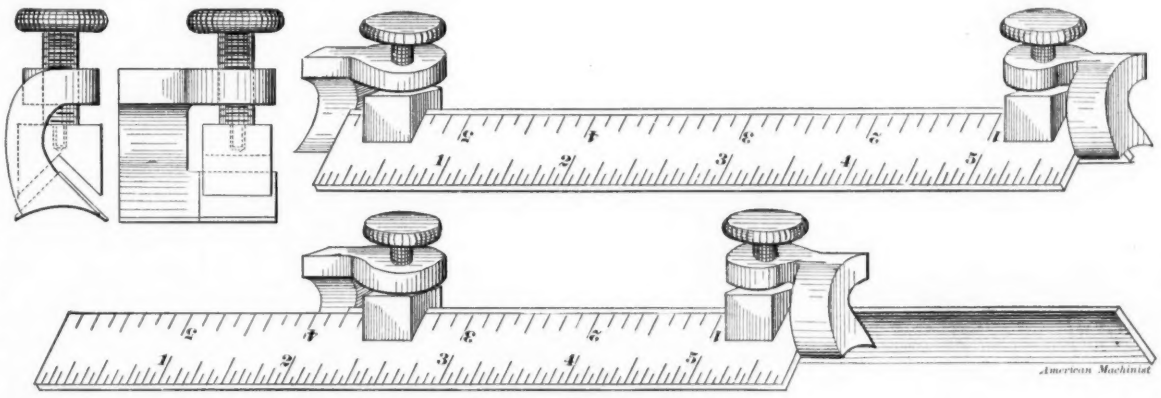
Each piston, with attached rod, is balanced, not by adding counterweights to the rim of the fly wheel, as usually done, but by coring out, opposite to the point where counterbalance is needed, virtually the same in effect, but with the difference that no impediment is offered to the wheels being turned up in a lathe.

We give engravings of indicator cards made from one of these engines, all the data necessary to an understanding of the action and distribution of the steam being given therewith.

Key-seat Rule Clamp.

The accompanying illustrations show a machinist's scheme for making a key-seat rule out of two ordinary scales or straight-edges, or one scale and a straight-edge, as may be most convenient.

The device will be readily understood by an inspection of the engravings, which show that it consists simply of two clamps, which are the duplicates of each other, and which are so made that the two scales to be used are clamped, as shown, onto surfaces which are square with each other, so that the two lower edges are parallel, and the key-seat rule is thus formed, and can be used the same as the regular tool for this purpose. It will be noticed also that the clamps are so made that one of the scales can project as far as may be desired beyond the clamp, and scales of unequal length can be used. This feature of being able to slide one scale beyond the other is frequently of great use also in measuring work, either in the lathe or on the planer. This device has been patented by Mr. James Carr, 506 S. West street, Syracuse, N. Y.



KEY-SEAT RULE CLAMP.

A gentleman, well known as a maker of recording gauges, has a little son of an inquiring turn of mind. The other evening the boy said to his father: "Papa, where is Atoms?" Father—"Athens, you mean; don't you, my dear?" Inquiring son—"No, Atoms, the place where people go to when the boiler explodes; because it always says they were blown to Atoms."—*Electrical Review.*

Some Rolling-mill Notes.

BY C. O. SINE.

A visitor, as he is shown through a rolling-mill, will not have much difficulty in dividing the employes into two classes, viz., those who are paid by the ton and those who are paid by the day. If our visitor is a student of labor problems he will here find an ample field in which to exercise his philosophy, and learn the condition of labor in "real life," and if his visit is made in the summer he will also have an opportunity of seeing an extensive collection of semi-nude statuary, some of which would rival the old masters in marble, for the employes who work by the ton are exceptions to Polonius' observation, that "The apparel oft proclaims the man," for many of them are covered with a perspiration, and but little else. Collectively, these men are known as "skilled laborers," and include puddlers and their helpers, heaters and helpers, rollers, roughers and catchers. The two latter "poke" the iron back and forth through the rolls.

The work of these men is perhaps the hottest of any in which the human family are engaged. Just imagine a pile of iron ten inches square and four feet long, at a soft welding heat, that is to be handled with a pair of tongs not more than three feet long, and the thermometer 90° in the shade. All piles are not as large as the one mentioned, but they are all as hot when they come to the rolls from the furnace. These men wear pants and shirts to protect them from the intense heat of the piles, while puddlers, whose work is not so hot, go nearly naked to keep cool.

Last summer a rougher brought a guide to the shop to have a piece cut off. I noticed that the little pool of water that had accumulated at his feet while he stood waiting for the guide to be cut was gradually extending its boundary, so I asked him if he fell in the creek as he came over from the mill. He informed me that that was *sweat*, and gave me an exhibition of pumping it out of his shoes by manipulating the joints of his feet. The average wages of these men is about four dollars per day; for an occasional good job this sum may be doubled for heaters, and squared for rollers. It is often said by day workers that it is wrong to work by the ton at all, for one ton worker will do as much as three day workers would do, thus making work scarce and men plenty. If all were day workers, many more men would be employed, and in consequence better wages could be demanded and received; but I have observed that men who have advocated day work, while they were working by the day, had a change of heart when they had an opportunity to take a job by the ton. The amount of work a man shall be allowed to do has always been a source of contention among the men themselves. One of the rules of their union is that any one (puddler) working iron other than that delivered to him shall be fined one dollar for the first offense, etc., which means that he shall not steal pig-iron from stock, and kill himself working it for the purpose of making a little more money. It will be seen that at least a majority of them are in favor of moderation, or else they would not adopt such rules.

Our puddlers charge five hundred pounds of pig-iron at a heat, and make five heats for a day's work, and are paid five dollars and a half per gross ton of muck-iron made from it; from this they pay a helper, leaving the puddler from $3.50 to $4 per day.

These skilled laborers have a barbarous custom of going to work at four o'clock in the morning. I have asked several why they did so, but never have received two answers alike. All that is known about it is, that the habit originated in Europe, and was brought here. It has not yet been Americanized. They have no regular time to take their meals. Those who live near enough to go and come in half an hour take their meals at home; others bring their breakfast and dinner, and may be seen at all hours broiling the savory beefsteak, making coffee, and boiling eggs, and partaking of their repast with an enjoyment that comes only to those who work for it.

I do not think that mill men are socially on a par with some other classes of artisans; many of them are exemplary citizens, a few have been elected to the highest municipal offices, and have acquitted them selves with credit. Many of them have saved their earnings and are independent, but the majority live from "hand to mouth." They are all interested in maintaining high wages, and this they have done by selecting the ablest and most diplomatic of their number to represent their interests in conference with their employers. These are paid as much or more than they could earn at work, thus securing the best talent for the purpose.

I cannot see anything in puddling (or boiling, as it is more generally called,) that is inspiring (no lack of perspiring)—nothing one can take pride in—no fine points in which to exercise some ingenuity. There is no difference between a good puddler and a poor one—all get the same price; one may, by being careful, not waste any iron, and thereby turn out more weight, which means more money for the puddler, and more profit for the firm; aside from this, all opportunity to exercise anything but muscle is to all appearances barred out.

In rolling finished iron there is room for the roller to exhibit his skill and ingenuity to any extent he may choose; for instance, in the rolling of very small rounds the variation of over one-hundredth of an inch from the size is not allowed; for such orders the roller is furnished with a P. & W. gauge, a double crescent style, one end being marked +, the other —; the iron must be rolled too large for the — end of the gauge, but small enough for the + end to go over it.

I often size pieces for rollers on special orders, and in doing so to-day I found a piece of half-inch round that did not vary one-thousandth of an inch from being round, nor three times that much from the exact size. This might be termed good luck (if there is such a thing), for I have never seen any rolled so perfect before. The difference in the plus and minus ends of the half-inch gauge is fifteen-thousandths of an inch now. It has been in use about two years.

The wear would be very slight, as they are hardened and not used often. In rolling large sections of Ts, Zs, and nondescript shapes for structural and other work, the roller must be endowed with the important factors of knowledge and experience, as well as a stock of general resource, with which to defend his rights against the superintendent and roll turner, and occasionally the men in his employ.

There is an occasional job around the mills or furnace, that is let out to some one who does it for less money than it costs to have it done by the day. As an instance of this kind, I will state that our company pays six cents per ton to have their pig-iron loaded from the furnace on small yard cars, and three cents per ton for unloading it from the cars on stock piles at the puddling-mills. On inquiry, I learned that one man had unloaded one hundred and eighty five tons in one day, one hundred and twenty five being about the daily average. After three or four years of this kind of work he is ready to go into partnership with some doctor for six months, and then dies. I know of but one American who has had a job of this kind; it was easy enough when he took it, but it grew with the plant, and instead of hiring help, as he should have done, he did it himself, and paid a doctor and druggist more than it would have cost him to hire help.

The pig-iron from the furnace is always loaded by Italians, who come here, work as hard as they can, live as cheaply as possible till they have accumulated a thousand dollars or other sum upon which they think they can return to "Sunny Italy," and live in idleness and ease for the rest of their lives.

About the time that items first began to appear in the papers announcing the invention of an air ship at or near Chicago, and the formation of a company with $20,000,000 paid-up capital, to make and sell them, we said we thought it sounded very much like humbug. We continue to hear a great deal about it, and pictures of the ship are appearing in various papers. It still seems very much like a humbug, and every new statement telegraphed from Chicago regarding it seems to make it appear more so. The last we have noticed of this is to the effect that a meeting of directors had been held, and the erection of mammoth factories decided upon, for which $2,000,000 would be immediately raised. The directors may

raise the $2,000,000, but we do not think their air ship will ever raise anything worth talking about.

Steel Tugboat "Pier," for the Department of Docks, New York.

Messrs. Brown & Miller, of Vulcan Iron Works, Jersey City, N. J., have recently signed a contract to build for the Department of Docks, New York, a steel tugboat with all appurtenances. Our illustrations show the engine, which is of the triple expansion, direct, over-head acting type with cylinders 12 inches, 19 inches, and 31 inches diameter by 20 inches stroke, with link-motion valve gear, piston valves without cut-offs on the high pressure, and intermediate cylinders, and a double-ported D slide valve without cut-off on the low-pressure cylinder. The duplicate piston valves, one for the high pressure, and two for the intermediate cylinder, are of cast-iron, and take steam at ends. The bridged ports have a combined area of not less than 12½ square inches for the steam port, and 25 square inches for the exhaust port in the high-pressure cylinder; and double these areas in the intermediate cylinder. In the low-pressure cylinder the combined steam port area is 56 square inches, and the exhaust port area 112 square inches.

Pistons are cast hollow. Each has two light outside packing rings, and one heavy packing ring, all of cast-iron; they are set out by steel springs. Piston rod of hammered mild steel $2\frac{15}{16}$ inches diameter with a ground taper, and shoulder at piston, and secured with a deep nut. The upper jaw of crosshead is forged in one piece with the rod, its back end forms the slipper, which has four brass gibs, lined with magnolia metal. The gibs are set out by the introduction of shims or liners instead of set-screws. The bearing surface on each gib is 30 square inches. Bottom jaw of crosshead is forged of steel, and secured by two steel bolts 2⅛ inches diameter. Wrist bearing boxes are made of composition. Connecting rods are 5 feet long between centers, 3 inches diameter at neck, and 4 inches diameter at center. The stub end has two steel bolts 2⅛ inches diameter, the same as crosshead. Crank-pin brasses are lined with magnolia metal. Wrist-pins of steel 4¼ inches diameter by 5 inches long. Crank-pins of steel 6½ inches diameter by 7½ inches long. Guides of cast-iron, strongly ribbed and bolted to column at back of engine. Crank-shaft 6½ inches diameter in smallest part. Cranks are set at 120 degrees, with the high-pressure crank leading. The frame consists of eight wrought-iron columns, each is turned to 3⅛ inches diameter, and squared where shown. Their lower ends fit in the bed plate sockets, and keyed in. Flanges are forged to the top of columns about 7½ inches diameter, 1⅛ inch thick, each of which is fastened with three steel bolts 1¼ inch diameter to the cylinder flanges.

The bed plate is provided with heavy flanges and bosses for ten 1¼-inch holding-down bolts on each side; these bolts pass down through engine keelson plate. Seven bearings are cast in the bed plate, and fitted with cast-iron boxes lined with magnolia metal. Length of forward bearing is 5½ inches, the two forward intermediate bearings, 5¼ inches each; the two after intermediate bearings, 7 inches each, and the two after bearings, 7 inches and 5½ inches respectively. Each cap is provided with two bolts 2⅛ inches diameter.

The reversing links are of the double-bar type, with four adjustable brass gibs on block, and a wrist-pin for valve stem jaw in the center. The links are designed to hang so as to shift nearly all the slip to the backing position. They are made of hammered iron with steel pins, mild steel blocks, and have double suspension links with adjustable bearings. The steam reversing gear consists of a steam cylinder and oil cylinder on a cast-iron frame, bolted in a substantially vertical position to a column of the engine. The toggle or link on the piston rod of steam cylinder connects direct to the rock-shaft arm.

The throttle valve is of cast-iron 4 inches diameter, placed on the port side of the high-pressure valve chest.

The line shaft is of hammered iron 6⅜ inches diameter in smallest part. The shaft is in two sections, with composition sleeves about $\frac{7}{16}$ inch thick in wake of the stuffing-box and stern bearing.

The propeller is of cast-iron with four sectional blades, 7 feet 4 inches diameter, and 11 feet pitch.

The condenser has not less than 1,000 square feet of cooling surface on seamless brass tubes ¾ inch diameter, and well tinned. The shell is cylindrical, of cast-iron, and is provided with composition tube plates and cast-iron heads. The circulating pump takes water on each side of disk, suction not less than 7 inches diameter, and discharge not less than 6 inches diameter. It is run by an independent vertical steam engine with cylinders not less than 6x6 inches.

The air-pump has a steam cylinder not

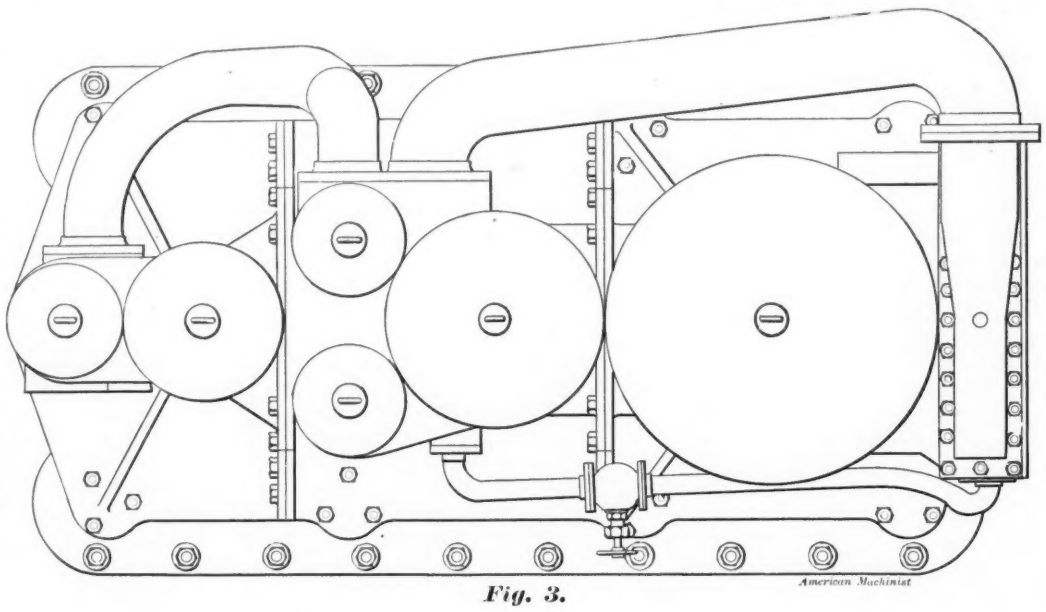


Fig. 3.

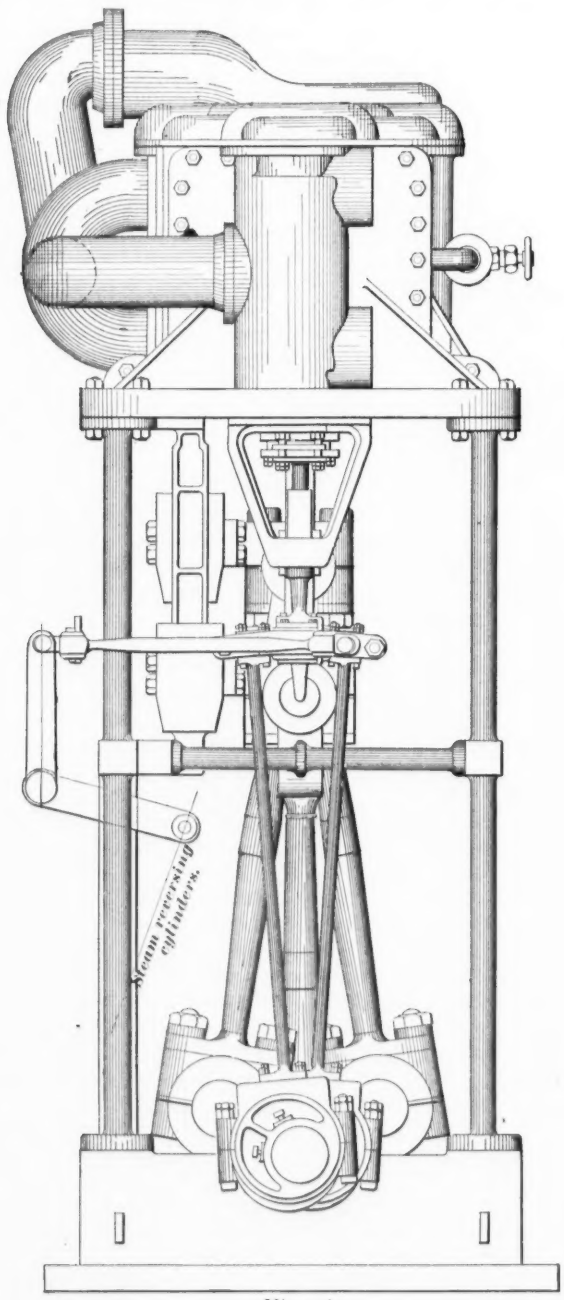


Fig. 2.

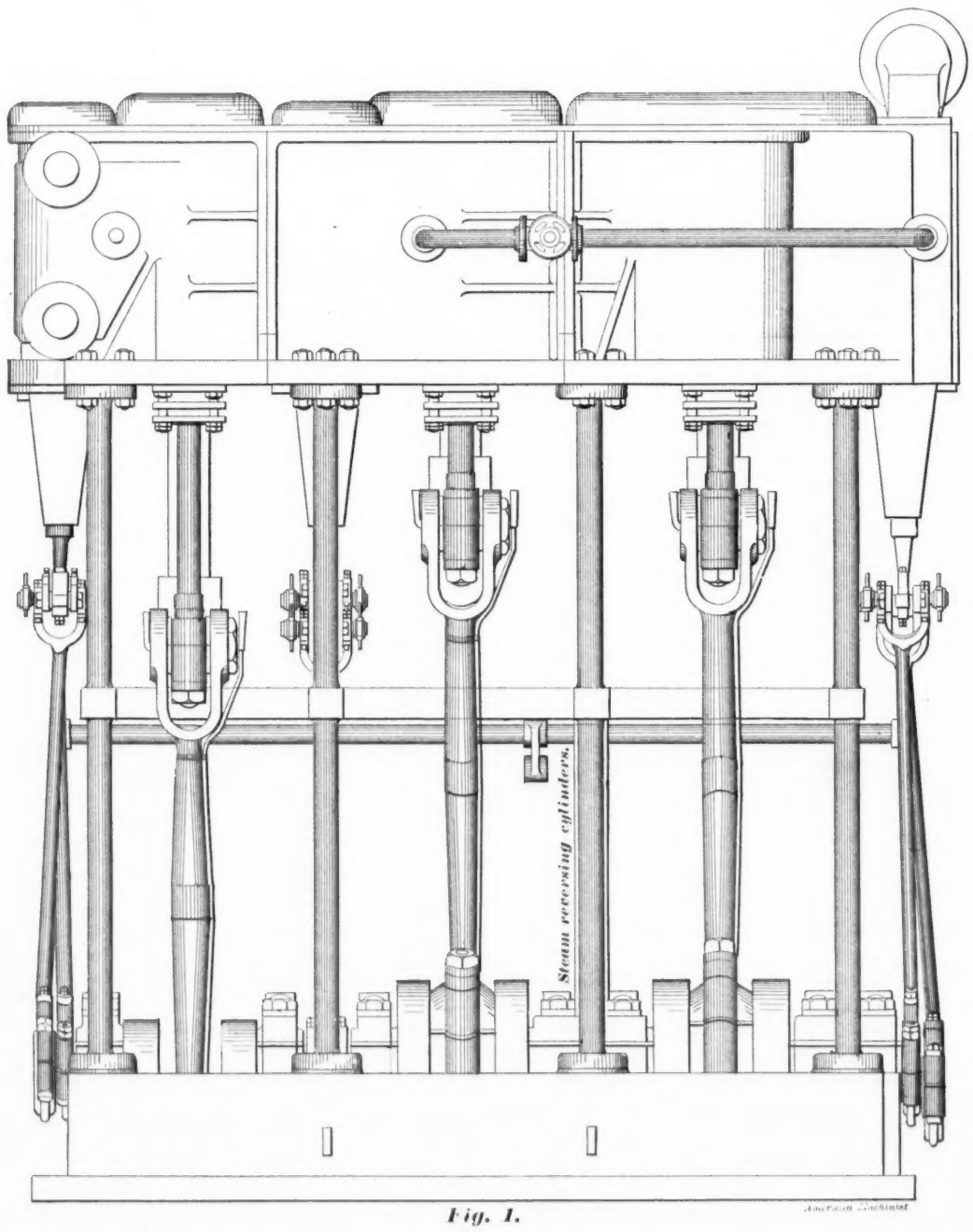


Fig. 1.

less than 8 inches diameter by 12 inches stroke, and an air cylinder not less than 12 inches diameter by 12 inches stroke.

The air-pump cylinder is brass lined; piston rod, stuffing-boxes, valve seats and valve bolts of brass, and pump piston of brass provided with adjustable fibrous packing.

Steam-feed pump with water cylinders not less than 3 inches diameter by 6 inches stroke, and steam cylinders not less than 4½ inches diameter by 6 inches stroke. The steam steering engine is placed close up under the main deck on port side, in wake of fire-room. It has two steam cylinders not less than 4 inches diameter by 4 inches stroke. The hand steering wheel, located in pilot house, is 5 feet 6 inches diameter. Main steam pipe of copper, 5 inches diameter. Main exhaust pipe 12 inches diameter, also of copper.

The boat will also be provided with a steam fire-pump of the vertical, duplex, direct-acting type, with two steam and two water cylinders, all double acting and connected with suitable cranks and fly-wheel. Steam cylinders 16 or 17 inches diameter by 11 inches stroke; cast-iron spring, ring packing in pistons. The area of steam ports in each cylinder is not less than 12 square inches, and that of the exhaust port not less than 25 square inches. Two water cylinders 10 inches diameter by 11 inches stroke. The whole water end is of composition throughout. The total weight of pump is not to exceed 5 tons, and the space allowed for it is 5 feet fore and aft by 5 feet athwartships by 10 feet in height.

There will also be furnished and fitted for use on board, the following special fire and wrecking equipment: Two 12-foot lengths of 8 inch suction hose and fittings. A brass strainer for the same. One 25-foot length of 4-inch fire hose and fittings. Four 25-foot lengths of 3¼ or 3½-inch fire hose and fittings. One 3½-inch ring nozzle and brass play pipe. Two 2½-inch ring nozzles and brass play pipes. Two 1½-inch smooth nozzles and brass play pipes. One brass Siamese 3½ inches by 3½ inches by 4 inches. Four heavy brass or wrought-iron swivel holders with sockets, fitted in rail to hold pipes from 2½ to 1½ inch. One heavy wrought-iron swivel holder with socket fitted in forward bitts to hold 3½-inch pipe. The boiler will be of the water tube type, with a total heating surface of 1,840 square feet; 44 square feet of grate surface, and not less than 140 cubic feet of water space when in steaming condition, and 100 cubic feet of steam space; working pressure, 200 pounds. The smoke stack is hinged, so as to enable the boat to pass under bridges.

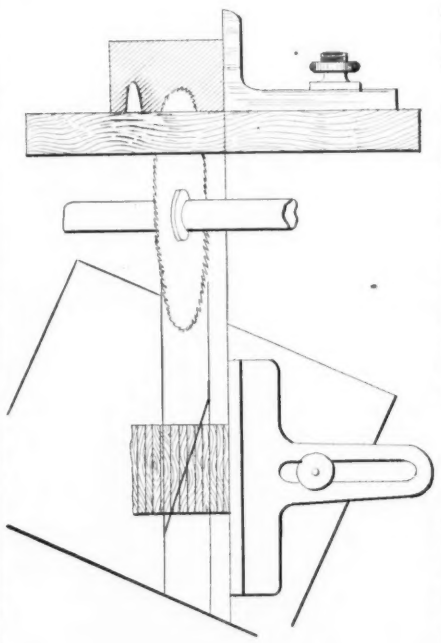
Length of hull over all...	98 ft.	0 inches.
Length on L. W. L.	88 "	0 "
Beam, molded.....	18 "	0 "
Beam over plating	18 "	1 "
Beam over all.....	19 "	5 "
Beam on L. W. L. molded	18 "	0 "
Deep load draught, extreme	8 "	0 "
Depth molded at frame 32,	10 "	7 "
Displacement to L. W. L.	150.5	tons.
Displacement per inch at same	2.2	"

Keel bar 6 inches deep by 1¼ inches thick, of hammered iron. Stem forging of hammered iron, in one piece, 6 inches deep; from sheer to about second W. L. to be 1½ inches thick, and to taper uniformly to 1¼ inch thickness at after end (frame 5), where it is scarfed and riveted to bar keel. Stern forging of hammered iron, comprising in one piece the post, shoe, rudder post bearing and a 2 feet 6 inches scarf for forward projection to keel; also bosses for propeller shaft and rudder stock. The portion of forging between rudder post and propeller shaft is 2 by 6 inches; in the shaft boss 2¼ by 7 inches; with a boss 15 inches over all, and bored 10½ inches diameter; below the boss it is 2x6 inches; in the rudder stock boss, 2x6 inches, and in shoe, 1¾x6 inches.

The frames are placed 20 inches from center to center throughout, made of steel angle irons 2½x2½ inches by ⅝ inch for three-fifths of the length amidships, and 2½x2½ inches by $\frac{5}{16}$ at ends. Floors of steel on every frame, ⅝ inch thick under engine and thrust, otherwise $\frac{5}{16}$ thick from frame 17 to frame 42 inclusive, and ½ inch thick in ends of vessel. Reversed angle iron of steel on every frame and floor 2½x2½ inches by $\frac{5}{16}$ inch, each in one piece extending along top of floors, and 6 inches beyond bilge stringer on each side, and each alternate reversed angle is prolonged to sheer stringer. Reversed angles are double on all floors, ⅝ inch thick. Bilge stringers are double on each side, of steel 3½ by 3 inches by $\frac{7}{16}$ inch, placed back to back in one length, continuous from stem to stern. These stringers come down to about the 2½ W. L. amidships, and rise at ends. Side stringers are placed on the 7 W. L. amidships, rising forward and aft. They are made double, of steel same size, and fitted in same way as bilge stringers, with a breast hook forward, and strong tie-plates aft. The plating is made of steel, placed "in and out." Garboard and sheer strakes are 30 inches by ½ inch; strakes between are ⅝ inch thick, except that on bow from about 8½ W. L. down, and aft as far as frame 8 at least, all plating is double, ⅝ inch thick.

The boat is to be known as "Pier." Messrs. Brown and Miller have commenced building the engine, and they may also build the hull. It is expected that the boat will be fully completed by the end of next August. The designer of the boat is Mr. William Cowles, constructing engineer and naval architect, 45 Broadway, New York.

One branch of the Missouri Legislature has evolved the brilliant idea of taxing sleeping cars about two per cent. of gross receipts.



Every Circular Saw an Ellipsograph.

A few days ago we received from Mr. George B. Grant a sketch from which we have had made the accompanying engraving. No explanation came with the sketch, but written on it were the words of our caption. The sketch, however, seems to make the matter clear, and shows how, by placing the gauge of a saw table at an angle to the saw, as shown, a portion of an ellipse can be cut out of a block, the proportions of the ellipse with a given saw depending upon the angle at which the gauge is placed. Discussions of the methods by which the proportions of an ellipse can be computed when made in this way will be found on pages 4 and 5 of our issue of January 17, 1889. Of course the same thing can be done by a thin milling cutter, or one which is ground at an angle so that it cuts on a narrow line only. The major axis or larger diameter of a complete ellipse made in this way would, of course, equal the diameter of the saw or milling cutter, and the angle to which the gauge must be set to produce a given minor axis can be found by dividing the minor axis by the major axis, the result being the cosine of the angle, which may be found in any table of sines and cosines. The formula is as follows: $\frac{d}{D} = \text{sine } a$. In which d is the minor axis, D the major axis, and a the angle to which the gauge is to be set, measured between the gauge and saw. Where the angle is already determined, and it is desired to know what proportion of ellipse will be produced, the formula is:

$$d = D \times \text{sine } a.$$

Rope Driving vs. Cut Gears.

Mr. George H. Richards, in his *Mechanical Progress*, notes the apparent tendency in England toward the use of gears for the transmission of power in place of the ropes, which have for the past few years been so generally superseding the gears formerly used. He says:

"Changing from ropes to gearing is not exactly *going back* to gearing, as the kind of gears taking the place of the ropes is not the rough cast gears used formerly. The present gears are machine cut gears, made to bear equally on each tooth, and with a contact across the whole face of the gear. We don't hear so much of late of the 'perfection' of cast gears, and the benefits of the hard scale or surface left on the teeth. This sort of engineering twaddle did very well when appliances were wanting for cutting the teeth of gears cheaply. It was making a virtue of necessity.

"Only a few years since, it was the exception in this country to find machine-cut wheels in machine tools. They were not wanted, it was said, because 'gears could be cast equally good, and then the cast gears would wear better—in fact, the conditions of good running gear could only be got by casting them from patterns, or molding them by machine.' The truth simply was that appliances for cutting the gears cheaply did not then exist, and do now only to a limited extent.

"During the past few years a rapid change has taken place. First, the Yankees commenced sending machine tools here with all the wheels cut, and charging no extra price for it. Next we hear of loom makers using cut gears entirely in the manufacture of this class of machinery, generally supposed to be the cheapest machine work—reckoning by the pound—produced in this country. At the present time, steel gears 30 feet in diameter are being made, with all the teeth cut, for transmitting the powers of engines in mills in the Oldham district."

The Fireboat "New Yorker."

The fireboat "New Yorker," which we fully illustrated and described in our issue of April 24, '90, underwent her first practical trial the other day in the East River, near the bridge, on the occasion of the burning of the Sound steamer "City of Richmond." The "New Yorker," owing to her improved fire shields, could get nearer the fire than any other vessel, and in fact served as a shield for other vessels. Her maneuvering was perfect, and her pumps and other apparatus for throwing water proved highly efficient. The hull of the burning steamer was so quickly filled with water that suction pipes had to be introduced below decks to draw it out in order to keep the steamer afloat. The hull and machinery of the steamer were saved, and the wharf to which she was moored, though it, of course, took fire and was badly scorched, was prevented from burning up. Of course the "New Yorker" did not do all of this, but she easily took the lead in the work, and can be said to have proven one of the most, if not the most efficient fire engine in existence.

Electrical Transmission of Power.

The proprietors of the Oerlikon Engineering Works, near Zürich, Switzerland, have conducted experiments for the purpose of demonstrating the possibility of transmitting current from Lauffen-on-the-Neckar to Frankfort-on-the-Main, a distance of 92 miles, at an electromotive force of 20,000 volts. Tests were made with pressures of from 15,000 to 33,000 volts, and the results were satisfactory. This having been found to be the case, the firm has decided to substitute electric motors for the present steam power in the driving of all the machine tools in the large works. A concession has already been obtained of the use of a waterfall in the village of Hochfelden, in the Glat Valley. The available water-power is sufficient to operate turbines capable of driving two dynamos of from 200 to 300 horse-power each. The current generated by these machines will be transformed to an electromotive force of 25,000 volts, and at this pressure will be transmitted by means of four overhead conductors of 4 mm. in thickness, and carried on standards 33 feet high, to the Oerlikon works, a distance of nearly 12½ miles. Here the 25,000 volt current will be again transformed to 50 volts, at which pressure it is proposed to drive the machine tools. This installation has now been commenced, and is to be finished in April.—*London Engineer.*

For softening water by means of hydrated oxide of lead cheaply, it is necessary to obtain the oxide, and the following method has been devised by M. Villon. A solution of sodium nitrate is placed in a vat, divided into two compartments by a diaphragm; lead electrodes of large surface are placed in the solution and the current from a dynamo then passed through. The sodium nitrate is decomposed, caustic soda being formed in the negative compartment, and nitric acid at the positive pole, from which it dissolves a certain quantity of lead, forming lead nitrate. When the current has passed through the liquid for a certain time, the solutions are run from the two compartments into a second vat, and there mixed by means of an agitator. The soda precipitates hydrated oxide of lead and itself forms sodium nitrate; the solution is then filtered, and the nitrate solution again submitted to electrolysis. When the baryta or lead oxide are used up, they are replaced by freshly prepared oxides. The purification by barytes is more perfect than that by lead oxide. According to M. Villon, the use of the filter press can be avoided by employing plumbate of sodium—a solution of lead oxide in caustic soda. The precipitate is simply allowed to settle out, and the water obtained shows a hardness of about two or three degrees.

A Liverpool correspondent says: "Directions have been issued to the London & Northwestern Railway officials at Rugby, Stafford, Crewe and Edgehill, to furnish the Railway Commission with a return of the hours worked by the respective staffs, and in connection with this there has been a remission of hours affecting drivers, signalmen and shunters. At Edgehill no shunter will work more than ten hours, and passenger guards are to be paid for Sunday duty, starting from yesterday, and goods guards are to receive for Sunday work time and a half, instead of so much a trip. The hours of shunters have been reduced to a maximum of ten hours per day. The maximum of hours for drivers and firemen has been reduced from fifteen to thirteen, and it has been ordered that a driver shall cease work within thirteen hours, rather than proceed on a journey in which he may exceed the limit."—*London Engineer.*

At a recent meeting of the American Society of Mechanical Engineers, Prof. J. Burkitt Webb called attention to the fact that the sustaining power of blocks of low efficiency did not necessarily prove that a low efficiency was needed in order to produce a self-sustaining block. This position he maintained against a proposed law of Sir Robert Stawell Ball, Astronomer Royal of Ireland, who, in his discussion of the self-sustaining feature of the Weston differential pulley block, announced as a law that "Whenever rather more than one-half of the applied energy is uselessly consumed by friction, the load will remain suspended without overhauling."

Professor Webb showed that, while it is perfectly practicable to produce a non-overhauling power by causing more than one-half the applied energy to be consumed in friction, yet that it was not necessarily true that a non-overhauling power could not be produced in any other way, and, indeed, he proved most conclusively that Professor Ball's supposed law did not exist.

LETTERS FROM PRACTICAL MEN.

Machine Designing.

Editor American Machinist:

What, to the uninformed, apparently denotes a lack of skill or experience on the part of the designer, is often, when fully understood, indicative of the greatest proficiency in those directions. The truth of this statement was recently very forcibly demonstrated by an incident that occurred under the notice of the writer.

The drawings for a machine were being examined in a shop, and, as is often the case, were freely criticised. "Why was this done?" and "Why was not that done?" were questions that were often asked. At last the veteran superintendent summed the matter up by saying the designer lacked practical knowledge of his business.

As he was an acquaintance, and a man of marked ability, the writer ventured to say as much. Just at this juncture, the gentleman in question came in, and as he is a remarkably good-natured man (by the way, this seems to be characteristic of competent men—Prof. Sweet for instance), the matter was referred to him. He explained it at once. He said, "We have a poor apology for a machine shop, and an equally poor machinist. We have a good carpenter shop, and good men in it. My concern insists that we shall do our work, as far as possible, within ourselves. I know this, in our case, to be bad policy, but I cannot change it. Consequently, I design for the carpenter shop, making everything of wood that can be; reducing machine work to a minimum." Looking at the matter in that light, the design evinced the greatest skill in adapting means to ends, as well as a thorough knowledge of processes. Many criticisms proceed from a lack of knowledge of conditions. One of the first things for a designer to learn, is his shop. The class of designing required in a first-class concern, like the Dickson Works, Scranton, Pa., for instance, would not do at all in the average country or city shop.

The best designer, from a mechanical or economic standpoint, is he who adapts his designs to the tools and facilities of the concern charged with carrying them out. Certain fundamental principles hold in all cases, but in the skillful manipulation of details, whereby the shop of limited capacity is enabled to profitably turn out work apparently far beyond it, consists the distinguishing characteristic of the good designer. He "makes the punishment fit the crime."

W. G. S.

Humors of the Shop.

Editor American Machinist:

John Law was a Scotch boy, an original investigator, and had a settled antipathy to being told anything, generally stopping his would-be informer with—"Muckle obleeged tae ye, but I would far rather fin' it oot for mysel'." So he was left mostly alone in his pursuit of information.

The shop engine where John worked was a vertical, with the crank on the end of the line shaft. The eccentric was a plane disk, and nicely polished, and was driven on a key sunk in the shaft, the ends of the key being finished flush with the face.

John had a dim idea that the office of the eccentric was to work something to make the engine go. Still, while the engine was running, the polished disk seemed to be sliding up and down and around through the shaft. He was greatly puzzled to know how the shaft renewed its continuity the other side of the disk. He had an idea that it was magnetism. Still that did not satisfy him. So just before starting time one noon he climbed up and drew a board across a beam, resting one end on an arm of the fly-wheel. John took a seat on the board, made marks on the shaft and disk, and feeling around the shaft, felt the end of the key. It dawned on his mind how the thing worked, still he thought best to wait till the engine started, to make sure.

The engine started, and down came John and board with a great clatter. John picked himself up, and hobbled off to his corner, rubbing the sore places, and muttering, "I fund it oout! I fund it oout!"

The brilliant young man who bored the cylinder head was told, when he was first promoted to a lathe, to "oil it up good all over."

So he got a rag and asked one of the boys where he should get some oil. Young Mischief told him to sop the rag in the bolt cutter trough. He did so, and coated the lathe from end to end, and from the top of the cone to the floor, with the black, greasy mass!

He got even with his tormentor in this fashion: Tormentor was given half a dozen 3″ solid pistons to shrink on their rods. Not having had practice at the fire, he asked his companion how to do it, and was told to "build a big fire on the forge, bury a piston in the middle, and blow as hard as you can for an hour, and it will be hot enough."

He did it, and at the end of the hour poked in the fire to get out the piston. He could find no piston, and concluded that he had forgotten to put one in. He made sure this time, and piling on more coal, blowed for another hour. At this juncture the foreman happened along and put an end to further destruction.

Not long since, four young "mechanical engineers," fresh from a noted university, were given the job to move a 16″ lathe from one shop to another. They were told to put it on skids, so proceeded to pry up the light side first, to get the skid under, when the lathe toppled over, wrecking the handles and feed apron.

The leader of the brilliant quartet threw down his pry in disgust, exclaiming, "Here I have spent four years' time hunting for the center of gravity, and now only just got onto it!" Benj. F. Wilson.

Screw Machine Work.

Editor American Machinist:

I send you a sketch of tools for doing the work wanted, in your issue of November 4 [1890].

Tools are intended to be used in a screw machine, but can be used in any hollow spindle lathe with a turret attachment. The work is held in an ordinary two or four-jawed chuck.

For the hole *a*, the tools are: A centering tool, Fig. 1; a drill the size of small end of hole, Fig. 2; a stepped reamer, Fig. 3, and finished with a reamer, Fig. 4. The step reamer 4 should have a cutting edge at *b* to square up the shoulder at *e*.

Tools for shank *f* are hollow mills, Fig. 5, the first one reducing the piece as seen at Fig. 6, and the next one to that seen at Fig. 7.

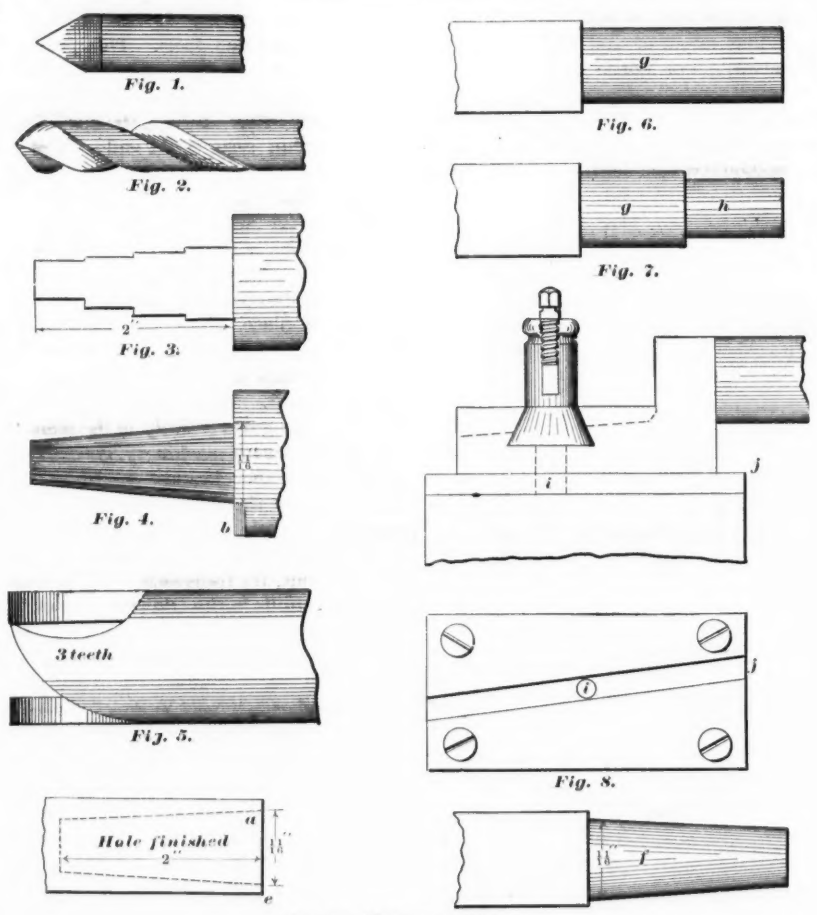
The tool, Fig. 8, is a box tool, with a taper attachment screwed to the bed of the lathe. The roll *i* runs in the slot *j*, and gives the proper taper. If a nice job is wanted, a box shaving tool can be run on after that.

Cost of the work will be about 13 to 15 cents per 100, unless it is in long lengths, in which case it will be more.

A good supply of lard oil will be needed to enable the tools to do good work.

A. P. Press.

[Our correspondent sent his communication in soon after the inquiry was published, but publication has been delayed.]



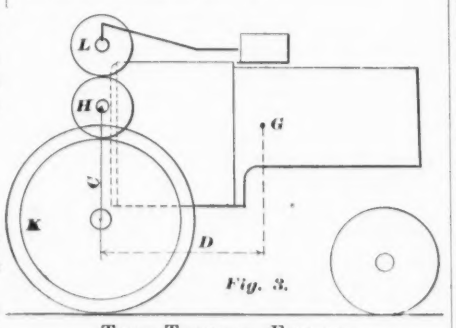
Screw Machine Work.

"That Traction Engine."

Editor American Machinist:

At the risk of trespassing too much upon your space, I venture to say that the reply to my communication on the above subject, published in your issue of March 5, does not seem altogether satisfactory, as I cannot reconcile some of the statements made in it with what appear to me to be self-evident facts. As will be inferred from my first communication, I think that the lifting force with a given cylinder and steam pressure depends solely upon the ratio of the gearing.

If you will kindly republish Fig. 3, we will, with your permission, look into the matter a little further. The statement of J. G. A. M., to which I wish particularly to call attention, is as follows:



That Traction Engine.

"But when we wish to determine what that lifting power is, we must take into account the leverage with which the pressure on the crank axle acts to produce rotation about the driving axle. This leverage is equal to the sum of the radii of the driving wheel *K*, and the wheel *L*, on the crank-shaft."

I have found it much easier to get a clear comprehension of such matters as this by considering what effect modifications of the mechanism would have upon the relative speed of the various parts, from which it is easy to decide what effect they have upon the force with which the various parts move or tend to move, because we know that the *moment of force* in any part of a train of gearing is always the same, being determined by multiplying the rate of movement of the given part by the force which would be required to prevent it from moving. This, of course, simply means that the force with which any part of a train of gearing would move against resistance is exactly in inverse ratio to its rate of movement. Now, keeping this indisputable fact in mind, let us suppose the engine, Fig. 3, to be turned over on its side, the cut then becoming a plan view of it in that position. Now conceive the driving wheels to be clamped to something which will hold them still, and the engine to be supported in this position by the axis of the driving wheels, so that it is free to turn about this axis in a horizontal plane. Now, leaving friction out of account, gravity will have no influence on the motion of the engine; but we will suppose that we supply its place by a resistance equal to the force of gravity applied at the same point (*G*), and to act constantly in the direction shown, *i. e.*, at right angles to the center line of the boiler. Now it must be evident that with a given cylinder, piston speed and steam pressure (the latter sufficient to overcome the resistance), the engine will rotate about the driving wheels with their axle as its center of motion, and that the speed with which it will rotate will depend solely upon the ratio of the gearing, and not upon the sum of the radii of the gears *K* and *L*; because, supposing the radii of these gears both to be doubled, then the linear velocity of gear *L* would, of course, be doubled, but it would, at the same time, have to travel through twice the distance in making a revolution about gear *K*, and the rate of rotation of the engine about the center would, therefore, be the same as before. And if the rate of rotation were unchanged it is almost unnecessary to call attention to the fact that the force with which the engine would move in its rotation about the axis of *K* would also be unchanged.

On the other hand, suppose that the gear *L* is reduced to just half its present diameter (thereby reducing the sum of the radii of the gears), it must be evident that, all other conditions remaining the same, the rate of rotation of the engine about the center of the axle will be reduced in exactly the same proportion, or, to one-half what it was before; and, as the same work is done by the cylinder, it must be also evident that the engine will move with twice the force, or will be capable of moving against twice the resistance, whereas, according to the statement of J. G. A. M., it would move with less force than it did before the change, because the sum of the radii of gears *K* and *L* has been reduced. Now, of course, it is evident that upsetting this engine in this way has not upset any law of mechanics; the same principles apply in whatever position the engine may be placed, and if the changes in the mechanism specified affect the rate of rotation of the engine about the center, and the force it can exert in so moving, as stated, then the same changes will in the same way affect the tendency to lift in front when the engine is working in its normal position. Many other modifications of the gearing will readily suggest themselves as being possible, but it will be found that with any possible modification the lifting power will depend upon the ratio of the gearing, and not upon the sum of the radii.

T. A. Pandie.

"The Born Mechanic."

Editor American Machinist:

In your issue of February 26, "A Victim" deals rather harshly with born mechanics, and what he says seems to call for a few remarks.

He seems to carry the idea that natural mechanics are not as competent as made mechanics, or those without natural genius, but have become what is commonly known as mechanics by a few years' course—a

technical school, or, still worse, three or four years' apprenticeship.

Such are mechanics in name only. Of course, I do not mean that a born mechanic, without experience, would be superior to either of the two above.

But put the natural mechanic through the same technical institution, or the same apprenticeship, and he will outstrip the unnatural one in every instance.

Why? Because it is perfectly natural.

Again, "Victim" does not institute a fair comparison. He educates the one that is to become a physician by several years of careful study and devotion to his chosen profession. Not so with the mechanic.

He has only to knock around his father's factory, or some other shop, until such a time as his mechanical genius gets at such a point in human events that it can no longer be kept down by the acts and sneers of older, unnatural-born mechanics; for, although they may have served a term of apprenticeship, and may be experienced, they never can attain that degree of mechanical skill that nature has endowed the born mechanic with. It is then, and not till then, that his genius will fully show itself, by way of promotion and rank.

I believe that there is a vocation for every one, and that, in order to make a success of this life, every one should follow his own particular bent. Some may be forced by circumstances to take up that to which they are not adapted, and they may make a partial success of it; but had they taken up that vocation to which their mind most naturally turned, they would have been entirely successful. There are exceptions, as there are those that cannot, or will not, make a success of anything they undertake. The latter class should keep their mind at ease, and work at ordinary manual labor.

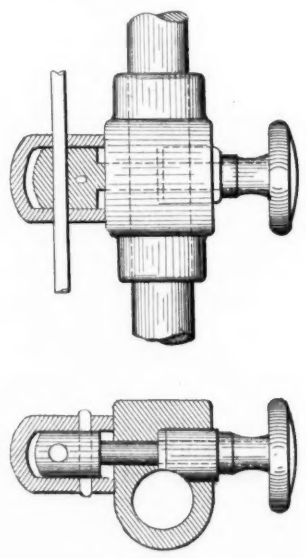
I hope none will jump at the conclusion that I am in favor of natural-born, unapprenticed mechanics, for I am not. But what I do mean is that none but born geniuses should try to be mechanics, and then that these should prepare themselves to the best of their ability. STUCK.

The "Born Mechanic."

Editor American Machinist:

I was interested in the reading of "A Victim's" account of the "Born Mechanic." We have all met him, and there is one of him in our shop. One of our regular amusements is to throw a copy of the AMERICAN MACHINIST in his way at noon time, and then listen to his comments upon the various things he finds in it. A good deal that is in the paper he evidently is not capable of understanding anything at all about, and so is discreetly silent regarding it, but all that relates to shop practice he considers himself the very best living authority upon, whether it be machine tool work, watch manufacturing, or marine engine building, and, like most of the born mechanics, he despises those who are not born mechanics, but have to pick up their knowledge of the business as best they may, and he is especially severe on any mechanic who confesses that he ever consulted a book relating to the science of mechanics. If a book is mentioned as an authority on any subject whatever relating to mechanics, he has always had some experience of his own which proves (to his own satisfaction, at least,) that the author of the book is little else than a fool and an ignoramus. I often wish that I had noted down all his comments on the various things published in mechanical journals, which we always take pains to throw in his way for the purpose of hearing him discourse upon them, but one or two cases which I happen to recall will serve to show the tenor of them. He noticed Mr. L. C. Sharp's illustration of an arbor for holding the driving axle brasses of a locomotive to turn the outside surface (issue of February 12,) and, throwing the paper down with a snort, he broke forth with, "What is the use of a fellow that calls himself a mechanic, writing such stuff as that? Perfect nonsense! Why, any lunkhead would know enough to put two of those brasses together, and turn them both in the same time that it would take to turn one! When I worked on locomotive work we used to put all the brasses for an engine on one arbor, half on one side and half on the other, and do them all at once." He thus tries to impress us with the fact that he knew all about locomotive work before any of the rest of us were born, but he is evidently ignorant of the important fact that driving brasses are made more than a half circle outside, and could not, therefore, be put together and turned as he says they should be.

Another writer spoke of the combined area of two main journals on an engine, and gave this area in figures, which were correct, and showed that they represented the projected area, which, as every one (nearly) knows, is considered the area of a journal, and is found by simply multiplying its length by its diameter. When our friend saw this statement, he broke forth again, and says he, "Now here is another fellow writing about mechanics who don't know how to figure the area of an ordinary bearing, and he has got less area in both those boxes than there actually is in one of them." We found by a little judicious questioning that our friend figured the area of a bearing by multiplying its length by its *circumference*. He, like a good many other born mechanics, is really a first-rate fellow in many respects, but he simply stands in his own way, and makes himself ridiculous by thus assuming that by simple intuition, and because he is a born mechanic, he must necessarily know more about everything connected with the subject of mechanics than others constructed on a different plan can ever hope to know, even by the hardest study and application. FAY.



Surface Gauges.

Editor American Machinist:

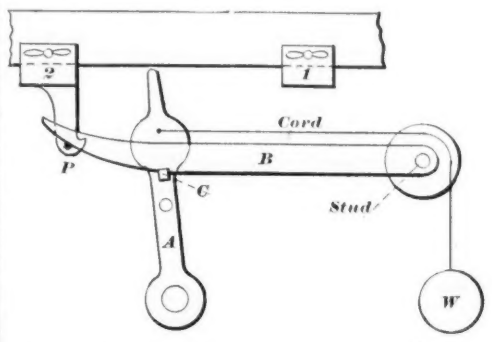
The talk lately in your paper, relating to "surface gauges," prompts me to send you the sketch herewith, of a design of clamp and pointer holder that I made some four years ago. It embodies no new principles that I am aware of, but I think it is a new combination for this purpose, and has one, to me, very great advantage, *i. e.*, no split joints for clamping, which always catch dirt, and I think are unsightly in small tools.

The clamps proper consist of but six pieces all told. The clamp on standard is on the same principle as used in the turret heads of some screw machines for holding tools. The bolt which holds this, and having the milled head nut at one end, is enlarged to a head at the other, over which a cap loosely fits; the cap and head of bolt are drilled to receive the pointer, and in such relation to each other that the cap comes to its bearing on the main clamp piece before the bolt head can strike, thus bringing a double shearing strain on the pointer, and holding it very firmly. There is also a little pin through both cap and bolt head driven in cap and in slotted hole in bolt head, to keep the parts together when the pointer is withdrawn.

For those who may not have seen the other clamping device as used on the main standard, I would say it is very easily made in this way: The hole for the standard being drilled, and also the hole for bolt at right angles to the first one, and quite close but not cutting into the first one, it is then counterbored for the clamping collar, which must fit free in the counterbore. It is then placed in position with bolt through, and fastened tightly, when a rose reamer may be run through the standard hole, which will shape the surface of clamp collar; a little stock then removed from its inner end will allow of the necessary motion to clamp the standard.

This in connection with Mr. Gribben's eccentric pointer, as described in Nov. 13th, 1890, issue, makes a very neat rig.

CHARLES S. BEACH.



A "Corliss" Attachment for Planer.

Editor American Machinist:

Having been a reader of your paper for many years, and gained many valuable hints, I enclose a drawing of an original (?) planer improvement. The planer is one of those single-belt affairs which will not cut nearer than 2" or so of the end of the stroke, but with this "Corliss" attachment it will cut to the end of stroke all it can pull. The dog 1 pushes the arm *A* forward, and the latch *B* then falls and holds on the lug *C*. At the other end of the stroke the pin *P* on dog 2 lifts the latch, and the weight jerks the arm *A* back. I am much interested in the improved ways of doing work I see illustrated and explained, but out here in California we have to do work without any ways. Such men as Mr. Rogers' foreman are what are required. F. B. WARRING.

San Jose, Cal.

The Tunnel Accident.

Editor American Machinist:

I noticed an article in your valuable paper in regard to the accident that happened on the N. Y., N. H. & H. R. R., in the tunnel in New York City, which has set me thinking, and I would like to ventilate my ideas a little as to the cause and responsibility of same. You will please note that I favor the engineer of the train, as well as the railroad officials. It may be well for me to say that I have "no axe to grind," as I am not acquainted with any of the railroad officials, or with the engineer of the train.

In my judgment there are two things that would cause the engineer of the train to disobey the danger signals. First, temporary insanity, and second, drunkenness. As there are two men on every locomotive engine, it would hardly seem possible to have the insanity "racket" take place, and as to drunkenness, I do not believe the railroad company would employ a man for twenty years and over, if he was addicted to the use of strong drink. If this engineer had been in the habit of disregarding the signals in order to get along as fast as possible, it seems that it would be done when he could see a train ahead of him. While I do not believe this took place, it might be so; but one would hardly suppose an engineer would do this on a day like the 20th of February, 1891, which was so foggy that you could hardly see in the open air, much less in the tunnel. As far as the system of signals is concerned, while they might be improved, I certainly believe the present system is all right, and affords sufficient protection to trains passing through the tunnel.

It may be well to say that a short time during my younger days was passed in the employ of a railroad company in the capacity of fireman on a locomotive, and I have a pretty good idea as to how engineers regard signals, and particularly danger signals, when on the road. I do not believe that the engineer on the N. Y., N. H. & H. train would risk his own life, particularly when he had three signals to warn him. You will of course understand from this that I believe the signals were set all right for the train to go ahead, and that there was something wrong with the mechanism. The public always rises up and creates a great commotion whenever there is an accident. They seem to think that it is always the result of carelessness, and usually the railroad company is blamed for the accident. If they would only stop and think of the large number of trains that pass through this tunnel every day, and of the very few accidents that occur, I think they would come to the conclusion that the whole matter is handled exceedingly well. I do not believe that it is possible to make or invent any system of switches or signals that will enable railway trains to be run, and be sure that no accident will happen, without the assistance of the signal tenders and the engineers. Some one has got to be trusted to perform the duties carefully, properly and correctly. The shop train was equipped with Westinghouse brakes, as are all trains passing through the tunnel, and I would like to ask if the brake did not have something to do with the accident. How many times we see trains stopped by the Westinghouse brakes, particularly the automatic brake, and it is impossible to start them. Of course, if the signals had been working properly it would not have made any difference if the Westinghouse brake had brought the shop train to a standstill. I simply mention this, as I have seen trains stopped a great many times by air brakes, and it was impossible to move them for several minutes, and then only by cutting out some of the cars, and abandoning the brakes, could the train be got under way.

You will note from the above that my judgment is, that the engineer did not disregard the signals, and also that the system of signals used by the railroad people is all right, and that the accident was purely and simply an accident in every sense of the word, on account of the signals failing to work properly. I will not undertake to explain why they did not work, but it strikes me that it is common sense to suppose that a man would not run into the rear end of a train when he could prevent it just as well as not. Would also say that the adopting of steam heat for trains is a good thing in everybody's mind, but cars will be destroyed by fire just so long as kerosene, or any other oil lamps are used in them. I believe that a quart of oil spilled in a collision from a headlight, or from a lamp in the car, or from a lantern, would take fire more readily and more quickly than a fire would start from an overturned stove. The chances are that the oil will surely spill, while the coal may not. I do not believe it is possible to operate trains so close together as they are run in the tunnel mentioned, without having an accident once in a while. E. D. ARNOLD.

Assistant General Superintendent
Troy (N. Y.) Steel and Iron Company.

Wants an Opinion.

Editor American Machinist:

I would like to ask some of your many readers which will give me the best result—to connect the main line shaft of a mill to the engine shaft with a coupling, or will it be better to run the line shaft with a belt? In either case they run the same speed. If there is any advantage in either, what is it?

J. T. MOWRER.

Harland & Wolff, of Belfast, have recently launched the "Nomadic," for the White Star line. The "Nomadic" is the first of two steamers, the second of which will be launched in a few days. The dimensions of these vessels are: Length, 460 feet; breadth, 49 feet; depth, 35 feet. Their register tonnage will be about 5,750 tons respectively, and, like their greater predecessors, the "Teutonic" and "Majestic," they will be propelled by twin screws. The twin screw principle has evidently come to stay for fast passenger service.

AMERICAN MACHINIST

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FRED J. MILLER, }

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The Tunnel Collision.

The coroner's jury, in the case of the Fourth avenue tunnel disaster, in which they charge the responsibility for the death of the victims directly upon the engineer of the rear train, and upon the officers controlling the management of the tunnel and the trains within it, proved a surprise to most people, and many are disposed to think it unduly severe.

It should be considered, however, that a coroner's jury's verdict does not finally settle such a matter, but simply forms a basis upon which the whole question can be subsequently fully examined in the courts, where the question of personal responsibility will be finally settled, and penalties imposed with more or less approximation to substantial justice. It is probable that the coroner's jury considered this, and simply took care that the verdict should be sufficiently strong and comprehensive to insure such legal investigation. Viewed in this light, the verdict is certainly a commendable one, and viewed in any possible light is far better than the kind of verdict which has become too common in such cases, and which simply evades the responsibility of declaring unequivocally that any one is to blame.

The evidence taken during the inquest is of a very conflicting character, and considering each witness' testimony by itself, would seem to prove that the signals were set against the engineer who ran into the shop train, and also that they were not set against him, but were clear.

We do not wish to prejudice the case, nor have we the least interest in throwing the blame upon one or the other of the parties, but in discussing the matter we can allow ourselves a latitude which will be denied the jury and judges who will finally fix the responsibility, *i. e.*, we can go outside the direct testimony offered, and be influenced in our judgment by what seems to be most probable in view of all the circumstances.

In the first place, we think that no engineer who runs trains through this tunnel, crowded with traffic as it is, fails to fully realize the danger and the supreme importance of *knowing* that signals are set clear before he runs by them. His own personal safety is at stake here, and though it may at times seem otherwise, we think most engineers think of the danger to themselves, and of the probable consequences of being upon an engine wrecked by a collision, or of jumping off when going at a high rate of speed. Signalmen have only such incentives to vigilance as the engineers have, aside from the important one mentioned, because collisions do not result in injury or death to signalmen.

Thus, so far as the question of whether the engineer or the signalman is most likely to perform his duty correctly is concerned, we think the chances are decidedly in favor of the engineer.

Levers which are placed beside the track at the signals are arranged to be struck by the wheels, as the engine goes over them, and if the signal is at danger, the movement of the lever causes a large gong overhead to ring. There was testimony to show that this gong was ringing as the engine was passing, and also to show that it might be expected to be inaudible to enginemen when going at an ordinarily high rate of speed. The engineer and fireman declare they did not hear it, and familiar as we are with the astonishing powers of accommodation to surroundings exhibited by the sense of hearing, we incline to the belief that they would have heard it if it had been ringing. We all know that men who are accustomed to attending machinery of any kind, in situations where there is a roar of noise made up of many and various noise-producing elements, become accustomed to this noise, and instantly detect the slightest sound which is irregular, and which persons unaccustomed to the regular noise would never notice amid the general din. This well-known accommodation of the ear to its regular surroundings makes it seem probable that if the gong had rung, the engineer and fireman would have heard it, no matter what the rate of speed, and considerations of personal safety, if nothing more, would have impelled them to heed its warning.

There are indications, too, both inside and outside the testimony offered, which seem to show that trains had been quite frequently let in onto a block by clear signals before the preceding train had left it, this being possibly necessary at times in order to prevent the tracks becoming blocked by the great number of trains run over them during the busiest hours.

The signalman, though he says positively that his levers were right when the train passed him, cannot say positively that the signal itself was at danger, for the very good reason that it was impossible for him to see the signal from his box, and the connections between lever and signal were known to sometimes stretch so that the signal would be "half cocked."

The engineer of the colliding train, along with the various officials, has been placed under heavy bonds for trial. If a case is made out against him we shall be interested in knowing how it is done. One thing seems clearly proven, *i. e.*, that the tunnel is often so thick with smoke that signals cannot be seen with any certainty, and another thing shown is that the system of signals is not as perfect as it can be and should be.

In our former reference to this matter we said that the fire seemed to have resulted from the headlight of the colliding engine, and not from car stoves. It seems probable now that fire resulted from both of them, one witness, who escaped from a wrecked car, testifying that he saw live coals upon the floor, which could have come only from the stove.

The whole matter seems in a fair way to be thoroughly investigated, and it is possible that, by the time the matter is settled, the tunnel will be better protected against such accidents. Public sentiment may be depended upon to demand that everything possible to be done in this direction be done.

Labor Cost of Machine Work.

We publish elsewhere an article by Mr. W. D. Forbes, in which he gives some of his experience in the way of getting work in mechanical lines done here and in Europe. Mr. Forbes, by force of circumstances rather than by inclination, probably, is rather cosmopolitan in his ideas. Just exactly what we mean by this is that force of circumstance has, as it were, impelled him to look upon both sides of the question.

We commend what he has to say in the matter to those who are in the habit, or are willing to form the habit—and a very good one it is too—of looking at both and all sides of a question.

There is, of course, a reason for the present attainments of American shops in the way of ability to turn out accurate work at small cost, and it is to the interest of all that this reason should be known as accurately and as generally as possible, in order that we may strengthen and add force to tendencies in the right direction, as well as avoid things tending in the wrong direction. It is difficult to say what the prime cause of it is, and we will each have our own opinion regarding that, but the chief immediate cause is, we think, undoubtedly to be found in the ambition possessed by our workmen, which leads them not only to work energetically, but, what is of far greater importance, to *think* about their work. This ambition may, of course, be ascribed to various causes, but it comes largely of the knowledge that thinking is paid for in one way or another, and that especially in a new and not fully developed country there are abundance of opportunities for those who are capable of and willing to think.

The "Pinkerton Bill."

What is called the anti-Pinkerton bill has at this writing passed the New York State Assembly by such a strong majority as to leave little doubt but that it will go through, unless prevented from coming to a vote in the Senate. According to the reports of the vote published in the papers, there are some members of the Assembly who, though they are not usually classed as anarchists, hold decidedly anarchistic views. For instance, Mr. Husted is reported as saying, by way of explanation of his vote against the bill, that "He believed in the right of every man to protect his own property, and of every corporation to do the same." This, so far as it goes, is, it seems to us, genuine red flag anarchy, and carried to its logical conclusion would give to every individual the right of making himself a walking arsenal, and shooting every one whom he supposed designed to interfere with any of his belongings. In modern civilized society the individual is supposed for the good of all to resign this natural—or, if you please, savage right—to society, in return for society's protection of him, and when his property is threatened he has the right to demand adequate protection from the constituted authorities, and failing to receive it, to demand from society full compensation for damage done. Such compensation has been awarded by the courts, notably in the case of damages resulting from the great railroad strike riots in Pittsburgh. Contrary to the generally accepted idea, a man who may have been graduated from an institution of learning, who wears good clothes, shaves, and washes his face, can entertain anarchistic ideas, and the employment and defense of the employment of Pinkerton guards is an instance of it. Any one who employs them is, whether he realizes it or not, guilty of an outrage upon society.

Fly Wheel Accidents.

According to a recently published press dispatch, a hat factory in Danville, Conn., was pretty thoroughly wrecked recently, and several of the employes seriously injured, from the breaking of a governor belt on the engine, which allowed the engine to race until the fly wheel burst.

Knowing the unreliability of press dispatches in such matters as this, we do not feel safe in concluding that the accident resulted from the cause stated, but, whether it did or not, it seems a good time to say that no owner of an engine is at all justifiable in allowing it to be in such condition that an accident can occur from that cause. Devices which automatically shut off steam upon the breaking of the governor belt have been in use many years, and any one who does not wish to use any of those that are regularly made and sold, can easily construct one for himself, or have it constructed by any machinist.

In view of this fact, it is little short of criminal carelessness to run an engine without such a safety appliance, to say nothing of its short-sightedness from a business point of view, or considering the possible destruction of property which may be caused by the slipping of a lacing, or the parting of a narrow strap.

We do not see how any owner of an engine can be held blameless for the death or injury of another, resulting from a broken governor belt.

Mr. O. T. Crosby read a paper before the American Institute of Electrical Engineers, which met in New York recently, on the results attained in some experiments made by him with an electric motor, which, in the experiments, attained a speed of 120 miles an hour. The motor in this case weighed 2.4 tons, ran upon a circular track two miles long, and was cylindrical in shape, pointed at each end to reduce air resistance. Some of the electrical papers are treating this matter as if it were of the greatest importance, and upon the strength of it are making some comparisons between electricity and other forms of energy as motive power. Of course, the matter may be of great importance to the electricians, but it will not be amiss probably to call attention to the fact that some people might consider that a comparison of a motor built for the express and sole purpose of developing the highest possible speed with other motors, in which many other things besides speed must be considered, did not prove much of anything with re-

gard to their comparative merits. Such a speed as that attained by Mr. Crosby's motor could, we think, easily be surpassed by a steam locomotive, if that locomotive were to be designed solely for the attainment of the highest possible speed, without regard to any other consideration. It is possible that electric motors may eventually develop higher speed than can be attained by any other form of motor, but before they can be said to have demonstrated their ability to do this, comparisons must be made doing the same work.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(122) G. L. B., San Antonio, Texas, writes: In order to settle a dispute, please inform me which is the heavier, a cubic foot of ice, or a cubic foot of water? *A.*—Ice is lighter than water; the fact that it floats on water proves that ice is the lighter of the two.

(123) C. E. B., Three Rivers, Mich., writes: I wish to be advised as to the best books which should be studied by a young machinist who wishes to advance himself and become a mechanical engineer, but who cannot attend a technical school. *A.*—See our issue of February 19, page 4, current volume.

(124) E. A. S., Hartford, Conn., asks: Is it practical to bore an elliptical hole on a lathe and work to figures? *A.*—Special chucks can be made by which this is done, or it may be done with a bar, which can be set at the proper angle by computation, as explained in an article on this subject published in issue of January 17, 1889.

(125) P. B., Cortland, N. Y., writes: Please tell me how I can keep the water out of the cellar. There is no drainage. The water comes through the bottom, and rises two feet, but this occurs only when there is a thaw. *A.*—We cannot advise you without examining the location of the house. It seems to us that a good architect or builder should be able to locate the source of the trouble, and advise you what to do.

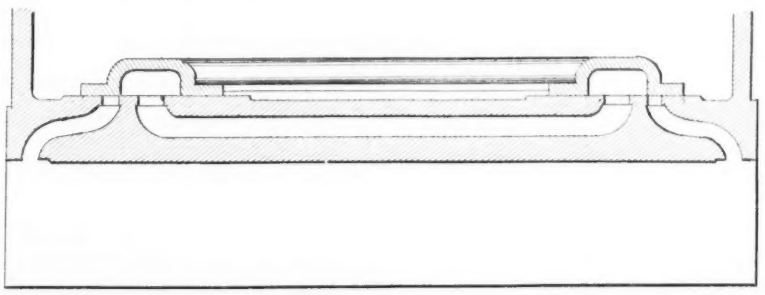
(126) T. D. K., Gowanda, N. Y., writes: I have read the article entitled, "Advice to an Apprentice," in the January 22 issue, and others at various times, with much interest, and I would ask you to outline in your columns, a course in engineering for home study, which will include all branches of the work, naming some for study and reference under each division. I think such an outline would greatly help many who are trying to improve themselves in this line. *A.*—See our issue of February 19, current volume.

(127) D. E. P., Woodsrun, Pa., writes: Please inform me through your columns if pressure is exerted on the internal or external surface of an ordinary boiler flue 10 inches or more in diameter? And is the effect the same in both cases? *A.*—In all ordinary flue boilers, the pressure is on the outside of the flues, tending to collapse them. If the steam pressure had been inside of the flues (but which is not the case in ordinary flue boilers) the tendency will be to burst the flues. The laws of resistance to collapsing and bursting differ.

(128) B. F. J., ——, asks: 1. Is there a machine for quartering locomotive driving wheels? *A.*—Yes. 2. What is a good way to quarter wheels without a machine? *A.*—Put them on the axle, and the wheels upon a level surface, and block them in position. Mark the center of the axle on each side, and without disturbing the position of the wheels, clamp straight-edges to each in such a manner that they will coincide with the center of the axle and the center of the crank-pin holes, one straight-edge being adjusted to this position by an accurate plumb rule, and the other by a level. 3. What would be the proper position of the pins when tramming? *A.*—On the centers. 4. Should the pins be left in the same position when the rods are put up? *A.*—Yes.

(129) W. C. D., ——, writes: A short time ago I had two wrought collars made, each with a 5″ hole, but one of 9″ outside diameter 2″ wide, while the other was 7″ outside diameter 4″ wide. The blacksmith and others claimed that the collar of the larger outside diameter would expand the most at the same heat, while I claimed that the expansion at the same heat would be the same. Which was right? *A.*—You were right. 2. I have a cast-iron flange 12″ diameter and 2″ thick, with a hub on one side 3″ long and 4″ diameter, a 2″ hole passing clear through. I claim that if the iron is sound the hole will expand alike the whole length. Others think it will expand more where it is 12″ diameter than it will where it is only 4″. Which is right? *A.*—You are right.

(130) E. C., Oglethorpe, Ga., writes: We have an engine 10x24 inch cylinder; its ports are $\frac{11}{16}$x4 inches, and 12 inches from valve seat to bore of cylinder, which causes considerable waste of steam at each revolution. Now what we want is a new cylinder with larger port area, and not so much length from the end of cylinder. Kindly give us dimensions of a cylinder suitable for the engine, and use steam economically. What troubles us most is to have such a large valve. The engine is very strong, and by making a new cylinder the engine will be useful. What will be the speed of this engine working up to 30 or 35 horse-power with a steam pipe 2½ inches diameter? *A.*—If the engine is not set too far away from the boiler, the steam pipe is large enough to supply steam for a piston speed of 450 feet per minute, or about 112 revolutions per minute. For this speed you will require a steam port area of nearly six square inches. We should make the steam ports ⅝ inch wide and 9½ inches long; width of bridges, ⅝ inch, and exhaust ports 1¼x9½ inches. If you intend to use slide valves, the steam and exhaust ports should be arranged as shown in sketch, which explains itself; this will greatly reduce the volume of the steam passages, and will give economy in coal. Of course you will need a good draftsman to make a drawing of the cylinder so as to fit other parts of the engine without making unnecessary changes or alterations.



(131) J. B. W., New York, writes: Please enlighten me on the following subject. In how many ways can a common slide valve engine be speeded up? Suppose we are getting 50 revolutions per minute, and we wish to speed her up to 75 revolutions per minute, the speed being regulated by a common throttle governor; diameter of cylinder, 12 inches; stroke of piston, 18 inches. *A.*—We see no other way than to change the gears or belt connections between the engine and the machinery which it drives; the gear or driving pulley on the engine must be reduced in diameter, or the diameter of the driven gear or pulley must be increased, or such changes made in both as will give the same result. The rotative speed is limited by the piston speed, and also by the size of steam ports, which should be large enough for a free exhaust. At 50 revolutions per minute the piston speed of the engine in question will be $50 \times 1.5 \times 2 = 150$ feet, and at 75 revolutions it will be $75 \times 1.5 \times 2 = 225$ feet, which is by no means excessive. For the latter speed the area of the steam ports should be,

$$\frac{\left(\text{diam. of cyl. in inches}\right)^2 \times \left(\text{piston speed in feet per minute}\right)}{7{,}639}$$

$$= \frac{12^2 \times 225}{7{,}639} = 4.24 \text{ square inches.}$$

The governor should be run at the speed which is marked upon it.

(132) J. W. F., Brooklyn, N. Y., asks: What is the rule for finding the working pressure of steam boilers? *A.*—The rule used by the supervising inspectors of steam vessels is as follows: Multiply one-sixth of the lowest tensile strength found stamped on any plate in the cylindrical shell by the thickness—expressed in inches or parts of an inch—of the thinnest plate in the same cylindrical shell, and divide by the radius or half diameter—also expressed in inches—and the quotient will be the pressure allowable per square inch of surface for single riveting, to which add twenty per centum for double riveting. To express this rule in symbols, let P denote the steam pressure in pounds per square inch; S, one-sixth of the tensile strength in pounds per square inch of metal; t, the thickness in inches or parts of an inch of the plate, and R the inner radius in inches of cylindrical shell; we then have,

$$P = \frac{S \times t}{R}.$$

If the tensile strength is 45,000 pounds per square inch then one-sixth of this strength will be $\frac{45{,}000}{6} = 7{,}500 = S$; and if the inner diameter of the shell is 44 inches, and the thickness of shell is ¼ inch = .25, then the allowable working pressure in boilers with single-riveted longitudinal laps will be

$$P = \frac{7{,}500 \times .25}{22} = 85.22 \text{ pounds per}$$

square inch. For a boiler with double-riveted longitudinal lap joints the allowable pressure will be $85.22 + (85.22 \times .20) = 85.22 + 17.04 = 102.26$ pounds. By taking one-sixth of the tensile strength of the plate, it may appear that a factor of safety of six has been allowed. But this is not the case; after allowing for the metal punched out of the plate for the rivets the factor of safety will probably be not much over three, if so much. It is for this reason that some engineers divide the tensile strength of the plate by eight instead of six; this will, of course, reduce the working pressure. For instance, taking the same example as before, we have:

$$P = \frac{5{,}625 \times .25}{22} = 63.92 \text{ pounds for}$$

single-riveted jap joints; and for double-riveted lap joints we have $63.92 + (63.92 \times .20) = 76.70$ pounds.

(133) E. C., Philadelphia, Pa., asks: What should be the size of a tank to hold the water flowing into it for four hours through a pipe ½ inch diameter; length, 20 feet; head, 10 feet? What is the formula for computing the same? *A.*—The first step is to find the velocity of flow, which may be computed by the formula given in answer to Question 98, in our issue of February 26. It is

$$v = \sqrt{\frac{64.4 \times h}{1.5 + \left(f \times \frac{l}{d}\right)}}.$$

In which h denotes the head in feet; in the example it is 10 feet; f, the friction factor, for which we may take a value of 0.02; l denotes the length of pipe in feet, which in this case is 20 feet; d, the diameter of the pipe in feet, in this case it is 0.041 of a foot, and v is the velocity in feet per second. Now substituting in the formula for the symbols their values we have,

$$v = \sqrt{\frac{64.4 \times 10}{1.5 + \left(0.02 \times \frac{20}{0.041}\right)}}$$

$$= \sqrt{\frac{644}{11.25}} = 7.5$$

feet per second. Multiplying this velocity by the cross-sectional area of the pipe in fractions of a square foot we obtain the number of cubic feet discharged per second. The area of a pipe ½ inch diameter is 0.00136 of a square foot, and

$$7.5 \times 0.00136 = 0.0102$$

of a cubic foot of water discharged per second; and the quantity discharged in 4 hours will be

$$0.0102 \times 60 \times 60 \times 4 = 146.88$$

cubic feet; which is also the capacity of the tank. If the tank is rectangular in form, 5 feet square at the bottom, its height will then have to be

$$\frac{146.88}{5 \times 5} = 5.87 \text{ feet.}$$

2. Which is the best power pumping arrangement to be used occasionally, and tended by a domestic, to fill the tank? *A.*—There are so many excellent pumps on the market that it is difficult to say which is the best. You must make your own selection.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Gears, gears, gears, gears, gears. See page 20.

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"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price $2, postpaid. Published by John Wiley & Sons, 53 East 10th St., New York.

MANUFACTURES.

Two extensive iron works are to be built at Coal Valley, Pa.

A brass foundry will probably be located at Shepang, Conn.

A cotton-gin, costing $10,000, has been built at Yoakum, Tex.

T. J. Lillard will probably erect an electric light plant at Elkin, N. C.

It is rumored that boiler works will be established at Chattanooga, Tenn.

The Strasburg Brick and Tile Works has been organized at Strasburg, Va.

A hardware factory, to cost $26,700, is to be established at Middleville, Mich.

E. H. Mason, of Atlanta, Ga., will establish a machine shop in Madison, Ga.

The establishment of a $25,000 cotton factory is talked of at Thomaston, Ga.

A machine shop will be established at Madesa, Ga., by E. H. Mason, of Atlanta.

E. M. Lewis will rebuild his machine shops, reported as burned, at Oxanna, Ala.

E. L. French, Shendun, Va., will start a tile and pressed brick works at that place.

The Buena Vista Steel Company has selected site for its steel plant at Buena Vista, Va.

A $125,000 stock company will be organized, to erect a cotton factory at Edgefield, S. C.

Trulock Bros. will rebuild their cotton gin at Pine Bluff, Ark., recently reported as burned.

An ice factory is reported as to be erected at Aiken, S. C. The mayor can give information.

Sioux Falls, S. Dak., is to have a new machine plant, which, it is expected, will employ 500 men.

W. C. Codd, of Baltimore, Md., is negotiating for the establishment of boiler works in Roanoke, Va.

A sugar plantation and mill, involving an expenditure of $40,000, is to be started near Edna, Tex.

Ground has been broken at Jackson, Mich., for the buildings for the new Columbia Foundry Company.

The Fort Payne Coal and Iron Co. (Ft. Payne, Ala.,) will, it is reported, erect an electric light plant.

The Rollstone Machine Works, of Anniston, Ala., are to be enlarged and the capital stock increased.

The Washington Zinc Company, Lynchburg, Va., have issued $100,000 in bonds, for use in enlarging their works.

The Phœnix Iron Works, of Cleveland, Ohio, is negotiating for the establishment of iron works in Roanoke, Va.

The Henrietta Mills, Henrietta, N. C., have decided to double their plant, making 25,000 spindles and 600 looms.

Thomas Bailey, who has bought a half interest in the Lyndon Foundry, at Athens, Ga., will put in new machinery.

The Citizens' Electric Light Company, Baton Rouge, Ky., will, it is reported, improve its plant, at a cost of $10,000.

The Chicago Foundry Supply Manufacturing Co., of Chicago, Ill., will construct a facing-mill 300x70 feet, to cost $50,000.

A large machine shop connected with the Duluth, South Shore & Atlantic Railroad is to start up soon at Marquette, Mich.

The Anniston (Ala.) Manufacturing Company will increase capacity and put in new machinery for manufacturing cotton.

Fraisse & Blum will, as reported recently, establish an ice factory at Houma, Ky., and have already let contract for its erection.

The Hazen Co., of Anderson, Ind., is now erecting an immense nail plant, and contemplates the erection of a steel billet plant.

The new foundry of Doherty Brothers, at Lowell, Mass., will be furnished with machinery to run by electricity, at a cost of $35,000.

The Walls Manufacturing Company, with $50,000 capital, will establish a stove factory at Indianapolis, Ind., to employ 75 molders.

E. C. Wehrfritz is reported as putting new machinery in, and enlarging his iron foundry and machine shops at Little Rock, Ark.

J. W. Womeldorf, of Cincinnati, Ohio, and J. J. Bright, of Pt. Pleasant, Ohio, are preparing to build a rolling-mill plant at Salem, Va.

It is reported that Haselton, Pa., is to have a nail factory of $120,000 capital stock. It is to be established on the co-operative principle.

The Richmond Standard Spike and Iron Company (Manchester, Va.,) will issue, it is stated, $110,000 of bonds, and improve its spike works.

The Ocala Light and Power Co. (Ocala, Fla.,) will, it is stated, erect a new building for its electric light plant, and put in new machinery.

The Key West (Fla.) Gas and Electric Light Co. will, it is stated, increase its capital stock $49,000, and put in a $40,000 electric light plant.

The Agricultural and Mechanical College (Miss.) is erecting a woodworking shop, and will soon erect a building to be used for foundry work.

It is stated that the Magnetic Machine Manufacturing Company, of Grand Rapids, Mich., will remove its motor works to Basic City, Va.

The Dustin Hardware Mfg. Co., Fort Payne, Ala., will meet on the 18th inst., to consider the feasibility of enlarging their machine works.

Crews & Westbrook have erected an additional builidng to their iron foundry and machine shop, also put in new machinery, at Danville, Va.

P. W. Pooser and others, recently referred to, will erect machine shops and operate as the Milledgeville (Ga.) Foundry and Machine Shop.

The Golden Belt Manufacturing Company, of Durham, N. C., has resolved to put new machinery into its bag factory, and double its capacity.

A new industry to be established in Woonsocket, R. I., is the Novelty Fabrics Co., which, with a capital of $100,000, will start a knit goods factory.

The Champion Compress and Warehouse Co. (Wilmington, N. C.,) has amended its charter so as to authorize it to erect a jute bagging factory.

A company has been organized in Huntsville, N. C., and $20,000 subscribed toward the building of a cotton factory. Building will begin in the spring.

A half interest in the Linden Iron Foundry, at Athens, Ga., has been purchased by Thomas Bailey, and new machinery will be put into the plant at once.

A $50,000 cotton factory is soon to be erected at Elmwood, Iredell County, N. C., by a Rhode Island man, who has purchased 70 acres of land at that place.

The stockholders of the Oswego Foundry and Malleable Works, Oswego, N. Y., have decided to increase the capital stock, and put in a malleable plant.

Smiley & Park will erect a six-stand gin at Brookston, Tex. They will be able to gin two bales at the same time, and turn out forty bales in a day.

The Kingsley Foundry and Manufacturing Company, of Elyria, O., have secured a location in Hammond, Ind., and will erect on it a plant to cost $30,000.

The Huyett & Smith Manufacturing Co., of Detroit, Mich., will build a two-story brick addition, 200x50 feet, to be used for the construction of hand blowers.

The plant of the Lone Star Iron Company, Jefferson, Tex., is expected to start up in a week or two. It embraces a blast furnace, with car wheel works attached.

J. H. Potter, W. J. Van Dyke, H. L. Wilson and others, are reported as to develop iron mines and limestone quarries near Canton, Ga., and to erect iron furnaces.

It is stated that N. S. Keay, of Philadelphia, Pa., is investigating with a view of establishing works to manufacture steel by the Bates process at Chattanooga, Tenn.

The Terminal Improvement Company has been organized at West Point, Va., to develop that place. W. L. Fleming, of Richmond, is president; P. H. Adams is secretary.

The Norfolk & Western Railroad Company (office, Roanoke,) is preparing, it is stated, for the erection of a new roundhouse and additional machine shops in Shenandoah, Va.

J. W. McConnell, W. R. Hall, Sydney Bowers and others have incorporated the Alabama Iron, Land and Furnace Co., to erect a 125-ton iron furnace, etc., at Talladega, Ala.

The Georgia Furnace and Iron Company, of Tallapoosa, Ga., are reported to have purchased, for $20,000, the Crow iron mines in Bartow County, Ga., and will operate same.

There is water-works agitation in Camden, Ark.; Niles, O.; St. Joseph, Mo.; Dothen, Ala.; New Castle, Va.; Clifton Heights, Pa.; Fairmount, W. Va.; Elgin, Ill.; Quincy, Ill.

The Bogenschutz Stove and Range Company has been incorporated, at Covington, Ky., to manufacture stoves, hollow ware and castings. The capital is said to be $100,000.

The Brown Hoisting & Machine Company (Cleveland) has bought about five acres adjoining their present works, upon which to extend their business, as the present plant is too small.

The name of a new town to be established by the Chattahoochee Land Company, near Atlanta, Ga., is Bolton. This company will here erect iron furnaces, rolling-mills and other industries.

The stock company recently mentioned as organized to erect iron foundry and machine shop, at Comanche, Tex., has been incorporated as the Comanche Foundry and Machine Company.

C. E. Snapp, architect, Shendun, Va., has just completed plans for the Shendun machine and repair shops at that place, on which work has already commenced. Building will be 108x106 feet.

The South Anniston Nail Works and Machine Shops, Anniston, Ala., have been destroyed by fire. The loss is placed at $30,000, covered by an insurance of $16,000. The works will be rebuilt.

The Chicago & Erie Co. will erect at Huntington, Ind., a building 250 feet long by 75 feet wide, in which to do car repairing. This will increase their force of shop hands at that point about 100 men.

An Ohio iron manufacturing company, is reported as having made a proposition to erect an iron furnace and rolling-mill in Trenton, Ga. M. A. Tatum, Chattanooga, Tenn, can give further information.

The South Chicago Foundry Co., of Chicago, has been incorporated, with capital stock of $50,000, for the manufacture of steel and iron; incorporators, Lynden Evans, Frederick Arndt, and J. A. Prescott.

The Hansel-Elcock Foundry Company is a new concern, at Chicago, with a capital stock of $75,000, for the manufacture of architectural works; incorporators, J. R. Hansel, E. G. Elcock and Peter Marshall.

The new machinery to be added to the equipment of the Ætna Mill, at Bridgeport, Ohio, will entail an expenditure of about $150,000. A structural iron-mill will, it is stated, be among the additions to be made.

It is believed that the machine shops of the Missouri, Kansas & Texas Railway in Texas will be removed from Taylor and Alvarado to Waco. Waco has pledged depot grounds, and, as understood, it will be accepted.

It is stated that the Belton Iron Works, of Belton, Tex., are removing their iron foundry and machinery to Comanche, Tex., where a $15,000 stock company has been organized by E. S. Wiseman and others to operate same.

The Atlas Iron Construction Company has filed articles of incorporation at Albany, N. Y. The company is organized with a capital stock of $50,000, to manufacture iron and metal work in New York and New Jersey.

It is understood that the Orswell Cotton-mills, Fitchburg, Mass., will be enlarged in the spring to the extent of adding about 50 per cent. to their manufacturing capacity. The addition will be one-half the size of the present mill.

The Martinsburg Mining, Manufacturing and Improvement Company has closed contract with the Common Sense Engine Company, of Springfield, Ohio, it is stated, for the location of a boiler and engine works in Martinsburg, W. Va.

Paris, Tex., is to have an oil-mill costing $125,000, to be built by home capital, and to be completed by the 15th of September. It will consume from 100 to 130 tons of cotton seed per day, and will turn out 100 barrels of refined oil every 24 hours.

The Canonsburg Iron and Steel Company, of Canonsburg, Pa., has decided to enlarge its capacity. The firm manufactures sheet iron and steel for stamping purposes and galvanizing. The present capacity is about 4,000 tons per year.

The Omaha, Kansas City & Galveston Railway Company, which proposes to build a railroad, has offered to locate machine shops in Denison, Tex., provided site is donated and a bonus given. C. M. Rawlings, of Lyons, Kan., is vice-president of the company.

The shops of the Ensign Car Company, at Huntington, W. Va., are at work upon an order for 1,000 cars for the Mexican International Railway, and several other large orders for Western roads. The company will soon commence upon a large addition to the car wheel shops.

The project of establishing steel tubular car works at or near Bradford, Pa., will be soon carried out, and it is thought that a site will be selected at an early day, and work commenced on the erection of the plant, which is calculated to give employment to 5,000 hands.

The Taylor Electric Signal Co., of Chicago, has been organized; capital stock, $500,900. The company intends to manufacture electrical and mechanical devices, and machinery for steam and street railways; incorporators, C. H. Merrill, Frederick L. Merrill, and Geo. W. Heth.

It is announced that the Iowa Barb Wire Works will shortly erect an annex to their plant at Allentown, Pa. The addition will be 100x160 feet of brick, and will be built to the west end of the barb mill, which will then be 100x300 feet, making it the largest establishment of its kind in the world.

The Keystone Mfg. and Supply Company, of Pittsburgh, have made application for a charter for the purpose of engaging in the manufacture of iron, steel and other metals. Among the incorporators are: Joseph W. Craig, Thomas H. Adams, Charles E. Dickson, Grant McCargo and Samuel M. Willock.

The Joseph Dixon Crucible Company will soon begin the erection of new and handsome offices at the works in Jersey City, N. J. The space occupied by the present offices will then be used for manufacturing, in addition to which there will be a further enlargement of the factory 100x100 feet, four stories high.

Joliet, Ill., it is reported, will soon secure a large tin-plate plant, to occupy twenty acres of land, and furnish a floor space of over 200,000 square feet. It is said a contract has just been executed between several Joliet property owners and Lewis Bros., of Pittsburgh, Pa., and Wales, whereby the plant will cost $500,000.

The Aluminum Steel Tool Company has been incorporated at Springfield, Ill. Its object is to sell certain patents pertaining to the manufacture of aluminum steel, and to manufacture and sell products covered by such patents, etc.; capital stock, $100,000; incorporators, N. H. Freeman, F. C. Ratan and T. J. Thompson.

A Pottstown (Pa.) dispatch states that the iron and steel firm of Ellis & Lessig announce that they have favorably considered the offer of $100,000 and 40 acres of land made by the citizens of Salem, Va., if they would remove their plant to that place. As soon as the present stock is worked up, and other matters arranged, they will move.

Arrangements are being made to increase the working force and the capacity of the Gulf, Colorado & Santa Fe repair shops at Gainesville, Texas, it being the intention of the company to move all the heavy repair work to the Gainesville shops in the near future, especially that portion of it that has been done in the Cleburne shops heretofore.

It is stated that the Scottish Middlesborough (Ky.) Land Company, Limited, has been organized at Glasgow, Scotland, with a capital stock of $1,000,000, to build iron furnaces, rolling mills, steel and pipe works at Middlesborough, Ky. They expect to begin operations about May 1st. The Middlesborough Town Company can give particulars.

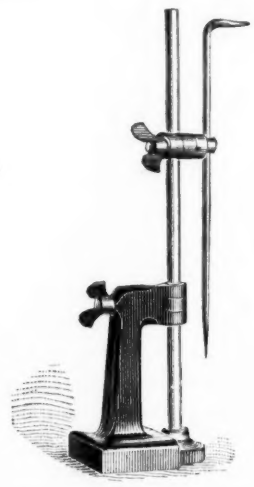
The Adams Laundry Machine Company, organized to make and sell laundry and other machinery, at Troy, N. Y., has been incorporated, with a capital of $30,000, divided into 300 shares. The operations are to be carried on in Troy, and the trustees for the first year are: Alonzo Sharp, John Ballie, Jr., Barclay Thomas, James W. Hislop and Arthur G. Gray.

A charter has been issued to the James River Steel and Iron Company, of Richmond, Va., formed for the purpose of owning, leasing and operating coal and iron mines, blast furnaces, steel works and iron plants. The capital stock is to be not less than $100,000 nor more than $200,000. The officers are A. E. Saunders, president, and L. T. W. Mayer, treasurer. The company includes quite a number of wealthy gentlemen, and the capital stock of $200,000 has been provided.

A machine shop, boiler shop and foundry will be erected by E. H. Bramhall at Camden, Me., next spring. Mr. Bramhall manufactures steam launches and pleasure craft, and proposes to manufacture steam engines, stationary and marine boilers, etc. The building that he will first erect is to be 46x52 feet, two stories, work upon which will begin as soon as possible. The foundry and machine shop are to be principally used for the manufacture of these engines, and boilers of Mr. Bramhall's own designing.

The following notice will explain itself: A copartnership has this day been formed between Frederick E. Reed and John R. Back, both of Worcester, Mass., which will continue the business of the manufacture and sale of machinists' tools, under the style and firm name of F. E. Reed & Co., heretofore carried on by Mr. F. E. Reed. Mr. J. R Back has for the last twelve years been connected with the business as foreman and superintendent for Mr. F. E. Reed. F. E. REED, J. R. BACK. Worcester, Mass., January 1st, 1891.—With increased facilities and strict attention to our business we expect to maintain the high standard of design and workmanship which has been characteristic of the machine tools manufactured by Mr. F. E. Reed during the past fifteen years, and fill all orders entrusted to us with promptness and dispatch. F. E. REED & Co.

The "Clipper" company, to which we referred last week as having had trouble with the "Harrow Trust," is announced to have settled its differences with that organization, and will sell its goods at the combination prices, and presumably refrain from putting into use any improvements which may be made in their line during the continuance of the agreement.



An Extension Surface Gauge.

The engraving on this page shows a surface gauge, in which there is an upward extension of the base, as shown, with an arm through which the stem passes, and may be clamped at any desired height by the wing nut.

The stem can also, of course, be put in place the other end up, and it can then be used as a depth gauge, or the scriber can be used to scribe a line below the surface of the work, as with a scratch gauge.

The stem is clamped in such a manner as not to bruise it, and the clamping and adjustment of the needle are entirely independent of this. It is made in three sizes—10, 15 and 20-inch—by E. G. Smith, Columbia, Pa.

Accuracy that can be Practically Attained by Hand-work.

BY JARNO.

Since the second paper went to print my attention has been called to a catalogue published in '86, by Pratt & Whitney, which states that light is perceptible through a space one fifty-thousandth of an inch wide, between a knife-edge—straight-edge and a flat surface. This statement is omitted in a later edition of the catalogue. The "Professor" had told me of an experiment that appeared to prove that light can be seen through a space a forty-thousandth inch wide between spherical nibs of a micrometer caliper. The experiment was made as nearly in bright sunlight as the eye can stand, and its success is considered by the "Professor" more as a mechanical feat than as anything practically attainable. In not repeating the statement made in their '86 catalogue, Pratt & Whitney may have a similar opinion.

A good way to form an idea of how

narrow a space light can be seen through is to look between two straight-edges that touch each other at one end, and are held apart by a piece of paper at the other end. Between the two straight-edges there is then a wedge of space that vanishes at the end where they touch each other, and increases to the thickness of the paper at the other end. Between them also can be seen a wedge of light that vanishes at a point near the vanishing point of the space. Now, by noting the distance between these two points, as compared to the whole length of the space, and figuring the same proportional part of the thickness of the paper, we find the width of the space through which we see the light. Before making this experiment it is well to wipe the straight-edges with white paper until it is no longer discolored.

My old acquaintance, Gascon, objects to my use of the words "thin pieces," in the second paper, as being not more definite than "fine lines." He is right. I should have given the thickness of the pieces or templates. Well, I mean that, when the templates are not more than two one-hundredths of an inch thick, and they come together, an edge of one to an edge of the other, so as to shut out light, then they do not vary from exactly fitting each other more than a ten-thousandth of an inch. This, then, is a practical limit, considered merely as a duplication, in fitting one template to another. If we have to originate a template from data it may have the variations, in drawing lines and cutting to them, which have been spoken of. The "Professor" showed me several pairs of templates that entirely shut out light.

There is need for a line gauge or scale having lines of different sizes, and figured to show the widths of the lines in thousandths of an inch. Let the scale have, say, five groups of lines, and ten lines in a group. Let every line of each group be of the same width, those in the first to be one one-thousandth of an inch wide, in the second two one-thousandths, and so on up to five. Such a scale would save much time and talk as to whether a line is too coar e or too fine.

We have heard that in mere manual skill the old-time machinist was the superior of the one of to-day. I think that this is a mistake. Though we have fine tools, yet the work required of them is correspondingly fine. In accuracy and speed of manual execution, I would match my pale-faced workman with any of all time. I have no doubt that in nearly every shop, at the present time, there are workmen that can work within the limits I have spoken of.

J. Elfreth Watkins, curator in the National Museum at Washington, thinks that we can judge of a nation's grade in civilization if we have one of its standard measuring instruments. I should like to see deposited in the museum a yard scale made entirely by hand. Give the workman a bronze casting from which to make his blank. For tools, give him two pieces to go with his blank, so that he can originate his own straight-edge; two more pieces, so that he can originate a square; a piece having two lines one inch apart, so that he can measure off his yard in length, and divide it into inches; a pair of dividers, a scratch awl, hammer, chisel and files. The tools, together with the yard scale, and a statement of the time taken to make it, would form a good record of the grade of manual skill in this last decade of the nineteenth century.

Ball Bearing for Drill Presses.

The illustration represents a thrust bearing for drill presses, which is being regularly manufactured by Josiah Ross, 1443–1459 Niagara street, Buffalo, N. Y.

As will be seen, it consists simply of two collars, which are provided with half-round grooves, in which the best hardened and ground steel balls are placed. The collars being so formed that, when the upper one comes down to its place, a flange or rabbet covers the joint between them in such a way as to exclude dirt and dust.

Mr. Ross informs us that he first made and put these bearings on his own drill presses, where they worked so well that others who expressed the desire to have similar ones were supplied, with the result that several hundreds of them are now in use, a patent having been obtained on some of the special features of the bearing. In most drill presses which are used at somewhere near their full capacity, there is no doubt that a large share of the power required to drive them is consumed by the friction in the thrust bearing, and in many cases there is undue wear there. This collar is intended to obviate the difficulty, and in most cases where it has been applied the increased driving power of the machine has been quite appreciable.

They are made in various sizes to suit any drill press, and when received are ready for application.

Sketches of an Apprenticeship.

BY W. S. ROGERS.

On one occasion, when our plant was just as busy as it was possible to be without "spilling over," one of the other shops in town sent us a cylinder for an elevator to be bored, as they had no lathe large enough to handle it.

They stated in the note of instructions, given us by the teamster who delivered the casting, that we need not drill the holes in the flanges—they could do that—but just bore it, and do it right away.

As I recollect now, I think the cylinder was about twelve inches in diameter inside and about five feet long. The Old Man and Tom walked around the shop, and "counted noses" with the various jobs under way, and concluded that not a lathe in the shop could be spared to do the job, and some other means must be employed or the work refused.

My chum John was on the drill press, drilling holes in a steam chest cover, when Tom walked around there, staring into vacancy, and in a brown study. "Say, Tom," said Johnnie, "what lathe are you going to bore that 'cast-iron well' in that old Waterberry sent up this morning?" "Can't spare any lathes, youngster," answered Tom.

I had a "cut going" on the small planer near by, so I told Tom I knew how to drill the holes in the flanges. "We don't drill the holes," said Tom; "but how would you do it?" "Make a pit, same as old Waterberry has by his drill press," I replied. "Say, Tom," put in Johnnie, in his usual spasmodic way, "if this here old drill spindle was long enough we could bore that 'well' right here—eh?" and John had become so absorbed in his scheme that he was working the feed the wrong way, and wasn't within two inches of his work, while I had discovered that my planer tool had taken several cuts of thin air. Although I carefully kept myself between Tom and that cut, and John pretended to have wanted his drill raised so high, Tom's sharp eyes saw everything, and while he cautioned us about being unable to talk and work at the same time, there was a "sociable" look in his eyes that told us we were not the worst cubs in the world.

Several times that day we caught Tom studying that old drill press and making calculations.

Next morning the laborers dug a pit under the front of the old press. The bottom was cemented, and an old cast-iron plate, with T-slots in its upper side, placed on the cement and leveled; then a brick wall built around the pit, which left a nice hole about three feet square. Then came the cylinder, and down in the hole went one end, resting on several three-inch parallel strips, the whole business being clamped down by some long bolts. Lastly, the jour. in the tool room brought a cutter head, and fitted in the top end, the spindle was brought down on the socket, and Johnnie was told to "bore that well." He bored the length of the feed, and backed his spindle out, leaving the cutter head at the bottom of cut, and put in a short arbor, which the tool maker had previously brought to him and instructed in its use. Again the spindle was fed down and backed out, leaving the cutter head twice as far down as at the beginning, a second arbor or mandrel put in twice the length of the first one, and the cutter fed over the third course, and so on the work progressed until finished. Old Waterberry came up to see how the job was coming on, and wanted to "kick himself" for not using his own drill and pit, and told us to drill the holes in the flanges while we were at the job. When he inquired of Tom how he came to think of that method of boring an elevator cylinder, Tom laughingly replied that "The cubs put him on to it, like most other makeshift schemes." Waterberry said it was singular that he could get no apprentices with ideas. His boys seemed only to work because idleness meant hunger.

BALL BEARING FOR DRILL PRESSES.

He barely finished his statement when our Old Man, who stood by, replied, with words that to-day seem like prophesy: "You have the wrong plan in your shop. You take a boy in to teach him the trade. You promise him he will be a machinist in three years. At the end of his apprenticeship he is *turned out*, because he has 'served his time'; but the only thing he has learned in those three years is to run either a lathe, shaper or planer—virtually, a 'machinist' in his own opinion, and worth three dollars a day; practically, an ordinary factory hand, a 'shaper man,' or, may be, a 'lathe man,' worth nine dollars a week. You turn him out, not because you have made him of value to himself and to you, but because you can get a new boy at three dollars a week, who will, in six weeks, turn out just as much finished work as the newly fledged jour. at two fifty or three dollars a day can. Then you don't dare let him know that he is not a machinist, nor how far short you have fallen in keeping promises made, and he is turned loose on the mechanical community, and gets it beat into him in time, after he has spoiled many jobs here and there. Just keep this way of making jours (?) up, and inside of twenty years we will have the *darnedest* lot of men working in machine shops we ever saw, while good mechanics and workmen will be scarcer than hens' teeth. I don't believe in getting boys into ruts and grooves. Stagger them all about the shop while they are cubs; they will get into ruts fast enough after they get away from us."

Waterberry winked at Tom, and said the Old Man was pretty good at "preaching," and he would try hearing a "sermon" every week.

But this was twenty years ago. Haven't we drifted to just where the Old Man said we would? And are we not still taking the apprentice boy, and making him serve three and four years on a shaper or planer, miller or lathe, to become a jour.? And doesn't he become expert on any one of those tools inside of six months? And at the end of three years is he a jour., or is he not simply a laborer, skilled in one particular item? Like one of the "Three Wise Men of Gotham," who learned to run a spinning jenny, would he not be liable to starve to death in the wilderness of plenty because there would be no planer to run?

Machinists' Supplies and Iron.

NEW YORK, March 14, 1891.

Iron—American Pig—The curtailment of production, from causes already noted, has had the effect of raising quotations somewhat, and there is a firmer tendency generally.

We quote No. 1 Foundry, standard Northern brands, $17 to $18; No. 2, $15.75 to $17; Gray Forge, $14.25 to $15; Southern brands No. 1 Foundry, $16 to $17.50; No. 2, $15.25 to $16; No. 3, $14 to $14.50.

Scotch Pig—The market continues dull.

We quote Coltness, $24.50; Dalmellington, $22 to $23, and Eglinton, $20.50.

Copper—The market continues dull and heavy. The Lake companies continue to quote 15c., but Lake can be had, it is reported, at a shade under 14c. from outside parties. Casting brands, at retail, are 11¾c. to 12c.; Arizona, 12¾c. to 13c.

Lead—The market is quiet, prices for car-load lots being 4.35c. to 4.75c.

Spelter—Though the demand continues light, a firmer feeling seems to pervade the market, and values for Western range at 5.05c. to 5.10c.

Tin—There is some indication of increased demand, and the market is firmer, though little actual trading has been done. Values range 20.10c. to 20.25c. for spot delivery.

Antimony—The general condition of the market is dull, but steady.

We quote Hallett's, 16½c. to 16¾c. Cookson's, 18c. to 18½c.; L. X., 16¾c.

Lard Oil—There has been an advance to 50c. to 51c. for Prime.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Wanted—Agents for fine surface gauges; big profits. Address E. G. Smith, Columbia, Pa.

Position wanted as practical draftsman. Address K., AMERICAN MACHINIST.

Wanted—Position by thorough detail draftsman; some exp. at designing. Moderate, AM. MACH.

Mechanical draftsman desires permanent position. Box 67, AMERICAN MACHINIST.

Draftsman, 1st-class designer on gen'l machinery, special exp. on electric work, A1 ref., desires engagement with resp. concern. Experience, AM. MACH.

Wanted—A few first-class machinists for engine work on tools and erecting floor. The Ball Engine Company, Erie, Pa.

Wanted—Position as draftsman; thorough exp. with Corliss engines, boilers and machine design; capable of taking charge. Reliable, AM. MACHINIST.

Wanted—Locksmith; steady employment to right party; knowledge of combination locks desirable. Address, with references, Repair Shop, AM. MACH.

Machinist wants a change; experience, engines and general mill work; experience in handling men. Address D. J., care AMERICAN MACHINIST.

Draftsman, familiar with gearing, fixture making and shop work, and experienced in electrical work, wants position. Address H. M., AM. MACHINIST.

Wanted—By prac. mach., position as foreman, or charge of erecting engines & power plants; familiar with water-works machinery. Box 64, AM. MACH.

Wanted—Foreman for iron foundry running 60 molders on pipe fittings and valves. Address, giving references, and salary required. Box 50, AM. MACHINIST.

Wanted—Two first-class all around machinists for light brass and iron work; quick workmen; permanent place; state salary. Minneapolis Brass and Iron Mfg. Company, Minneapolis, Minn.

Wanted at once, first-class machinists and machine erectors, for outside work; men familiar with rolling-mill and blast furnace work preferred. Address G. P. Raidabaugh, Sparrow's Point, Md.

Machinist, qualified to handle men to advantage, speaking German and English, is looking for engagement; well up in engine and tool work. Address Box 65, AMERICAN MACHINIST.

Wanted—Foreman for foundry located in a large western city; one who is familiar with fine machine and car wheel work preferred. Address D. F., care AMERICAN MACHINIST, giving reference, and salary expected.

Wanted—Experienced hand on Gleason gear shaper for day turn; also first-class men to run large horizontal boring machines on night turn. Apply to Bement, Miles & Co., 21st and Callowhill streets, Philadelphia.

Wanted—Foreman for shop constructing light machinery and contract work; must be able to estimate on work from drawings and samples; take entire charge of factory; a worker wanted who can push and control men. Competent, AM. MACHINIST.

Wanted—A man who thoroughly understands repair work on small intricate and fine machinery; must be sober and well recommended; steady employment can be given such a man. Address, stating wages wanted, The Ames Bonner Co., Toledo, O.

Wanted—A number of first-class machinists to work on ice and refrigerating machinery, and stationary engines; good wages and steady work to first-class men. Address Frick Company, Waynesboro, Franklin County, Pa.

Wanted—Three or four boys to learn the machinist's trade, not less than 17 years of age, and to have a fair common school education. Application must be made in own hand-writing. The Hendey Machine Company, Torrington, Conn.

A pushing, practical foundry foreman with good executive ability in handling work and men, well up in mixing and melting metals, core making and general foundry knowledge, wants position; engine work or heavy machinery preferred. American, temperate, age 36, references A 1. Address Box 56, AMERICAN MACHINIST.

Wanted—At once, a first-class machinist to give instruction to students in college shop, on general machine tools, brass, foundry and pattern work. Address, with references, stating salary expected, age, experience, education, ability to draw, and knowledge of iron foundry and blacksmith work, A. J. W., Box 106, Ames, Iowa.

A pushing, practical mechanic and fair draftsman (31) wants a position as foreman of machine shop, or charge of engines, boilers and machinery; has held such positions; can give best of reference; had large experience in mill work and repair work, besides building engines, furnace, saw-mill and wire nail machines. Address J. H. B., Box 432, Greenville, Mercer County, Pa.

✝ MISCELLANEOUS WANTS ✝

Advertisements will be inserted under this head at 35 cents per line, each insertion.

, Cheap 2d hd lathes & planers. S. M. York, Clev'd, O

Just out: aluminum steel hack-saws, hard but not brittle. Crescent Mfg. Co., Cleveland, Ohio.

New catalogue of engineers' specialties free. Crescent Mfg. Co., Cleveland, Ohio.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

Wanted—Customers for our new Radial Drills. C. H. Baush & Sons, Holyoke, Mass.

Wanted—Specialties to build for the Southern trade. Bluefield Iron Works, Bluefield, W. Va.

For Sale—50 horse-power Babcock & Wilcox boiler, in excellent order. Address Box 66, AM. MACH.

Wanted—A 50″x46″x10′ planer; state make and width of table. F. X. Hooper & Co., Baltimore, Md.

Engineers wanted to send their addresses and receive free a 25 cent book, "Hints and Suggestions for Steam Users." Lord & Co., P. O. Box 1262, Phila., Pa.

Pulsometer Pumps—Several sizes, nearly new, cheap; 8 horse-power Lidgerwood hoister, large water motor, exch'g. 165 First st., Jersey City, N. J.

Wanted—Some reliable firm to manufacture, on royalty, my patent tubular sled, or will sell; send for circular. John I. Hancock, Montrose, Pa.

Wanted—Engineers to write for catalogue of all the latest and most valuable mechanical, scientific and electrical books which are given free with each barrel of the Pittsburgh Boiler Scale Resolvent. Pittsburgh Boiler Scale Resolvent Co., Pittsb'gh, Pa.

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Three Styles, 15 lb. to 500 lb. Heads.

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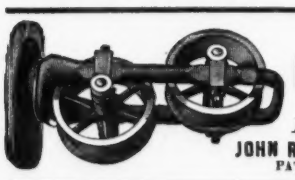

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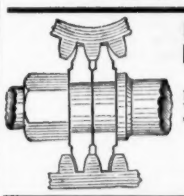
VERTICAL SPINDLE MILLING MACHINE.



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For circular and prices, address

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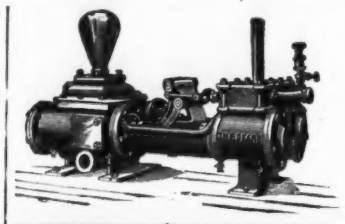

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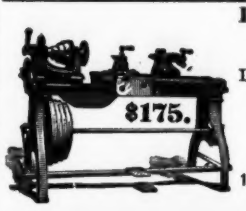

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Drill Presses, Shapers, Band, Circular and Scroll Saws. Machinists' Tools and Supplies. Lathes on trial. Catalogue mailed on application.

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Torsional Strength equal to the best Machinery Steel.
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CAN BE FORGED HOT.

Round, square, and hexagon bars for pump, piston rods, bolts and screws. Yacht shafting. Rolled sheets and plates for pump linings and condenser tube sheets, &c. Spring wire.

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For Machines or Information, address the Manufacturer,

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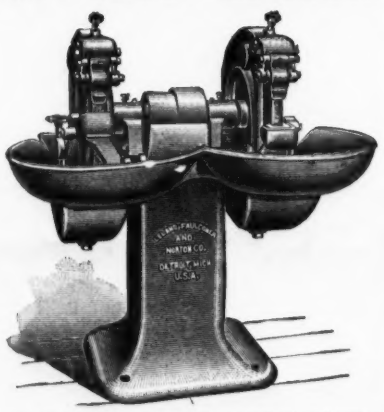

Any amount of water easily applied without the use of Pump, Hose, Treadles, Cocks, or any of the objectionable features common in this class of Machine. Truing Device, which is inexpensive, does the work perfectly and quickly. The whole rig practically as simple as the old-fashioned grindstone trough and much more effective. Send for circular.

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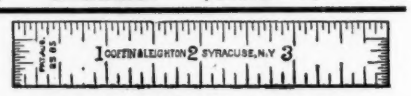

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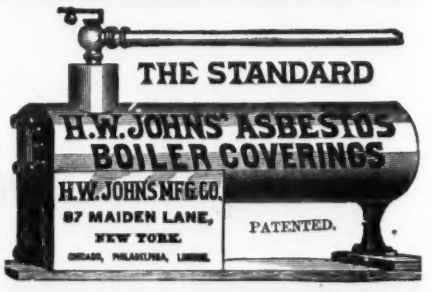

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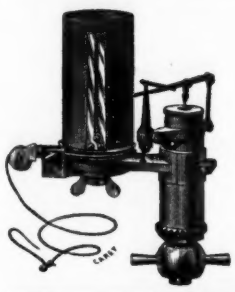

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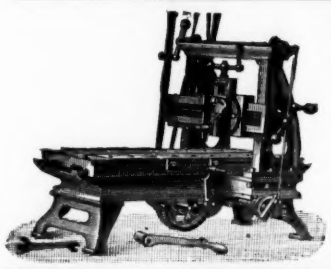

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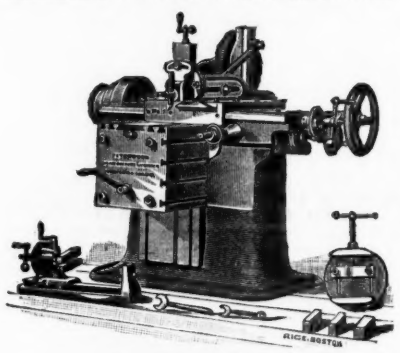

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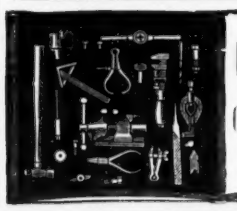

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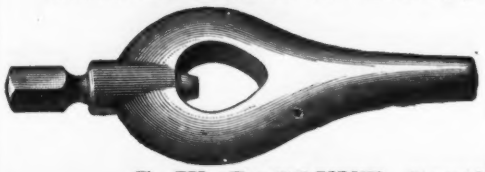

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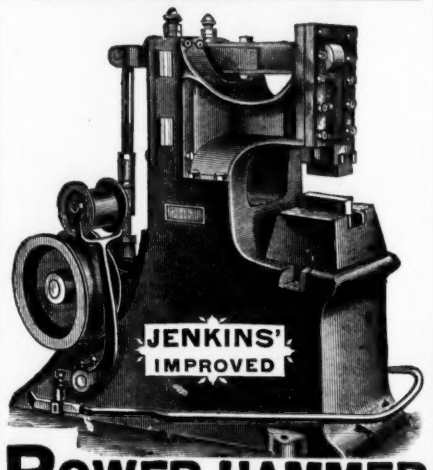

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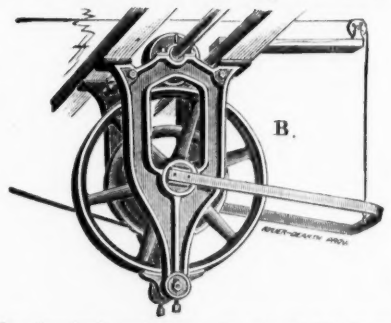

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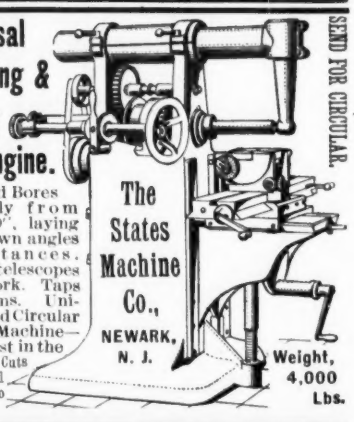

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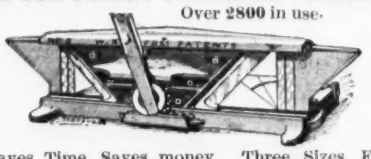

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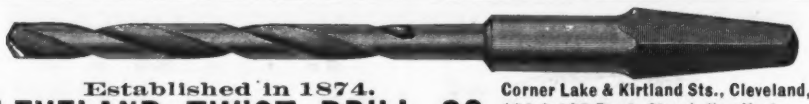

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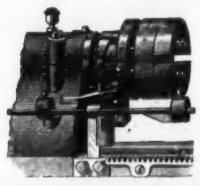

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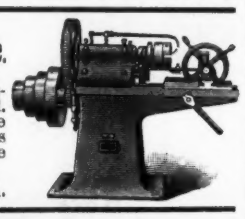

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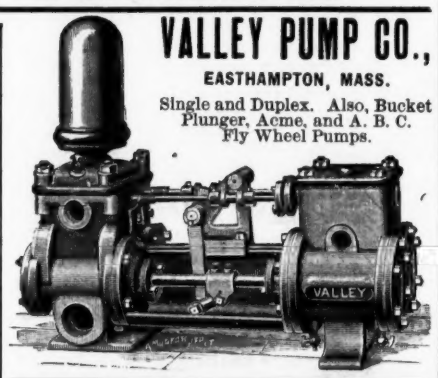

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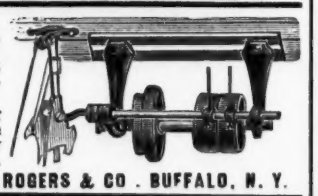

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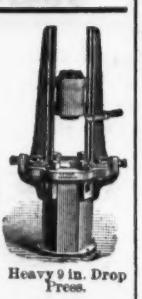

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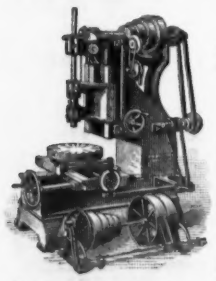

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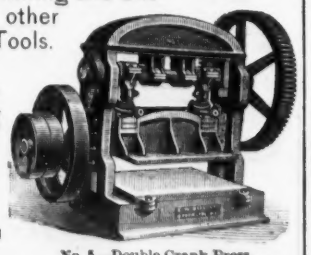

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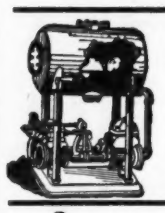

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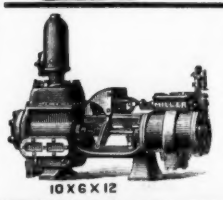

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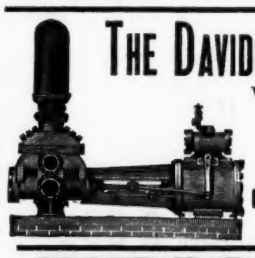

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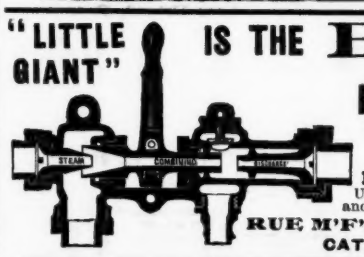

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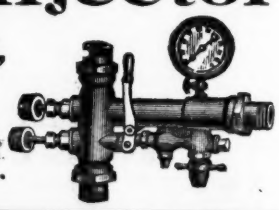

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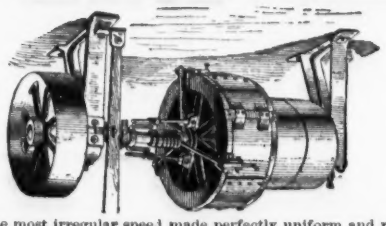

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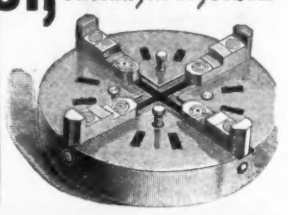

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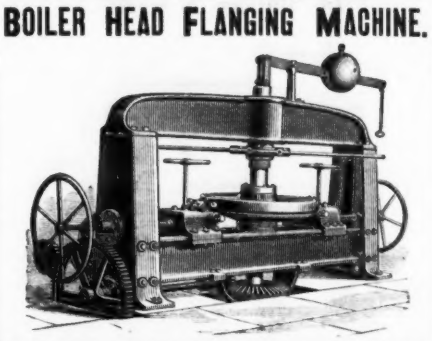

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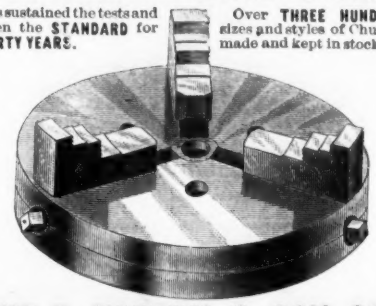

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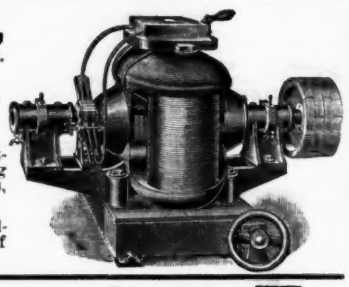

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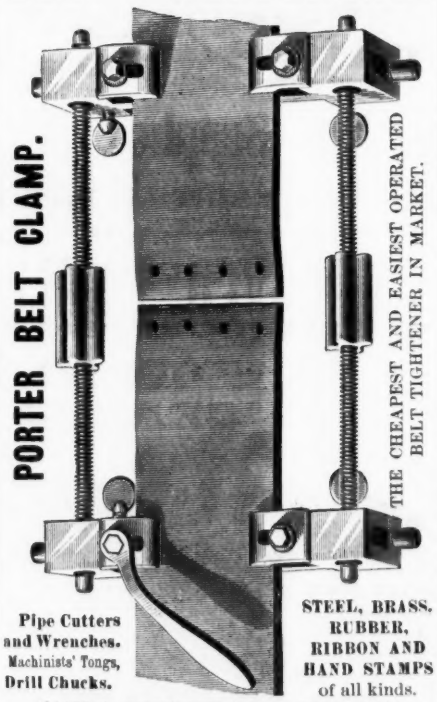

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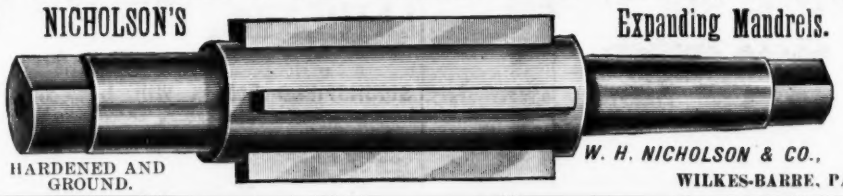

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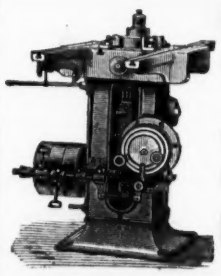

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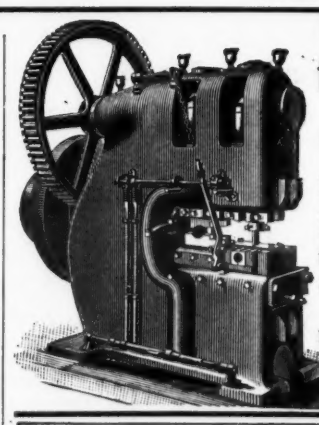

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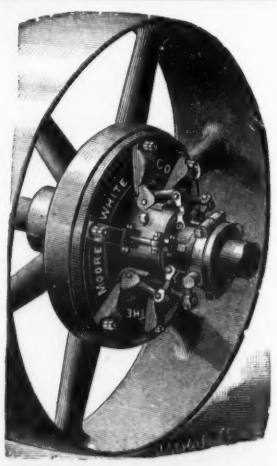

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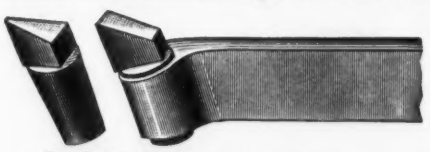

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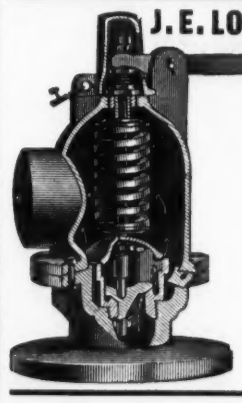

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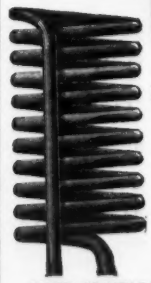

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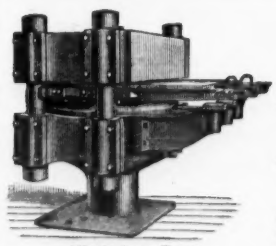

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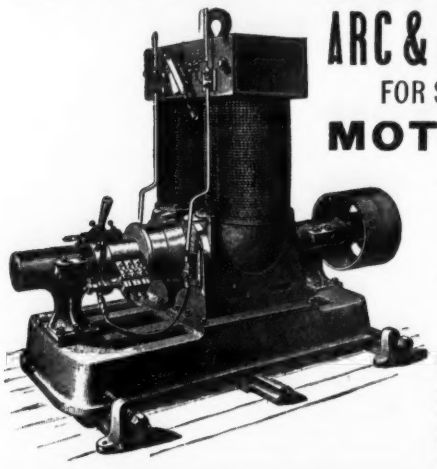

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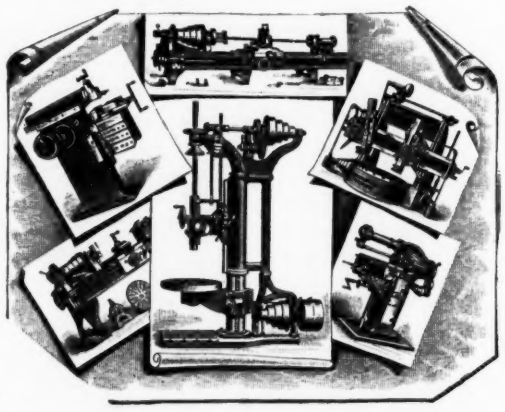

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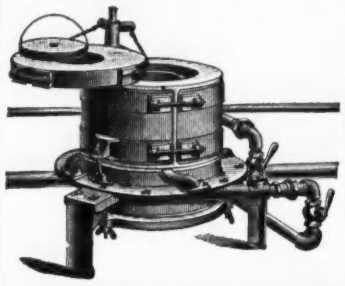

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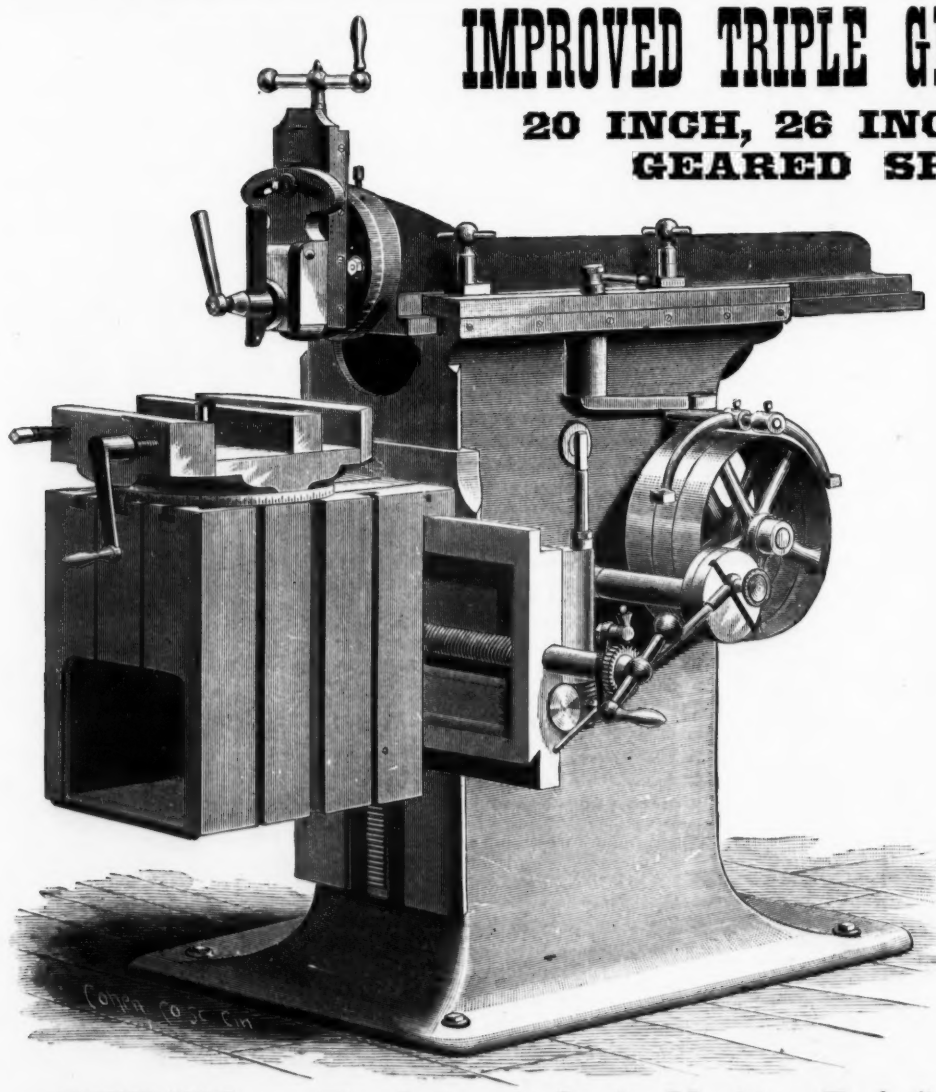

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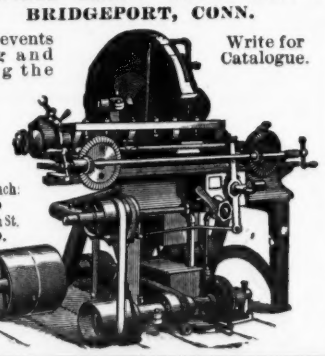

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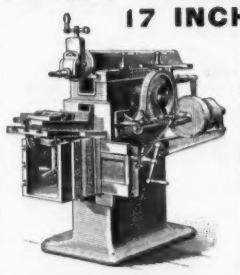

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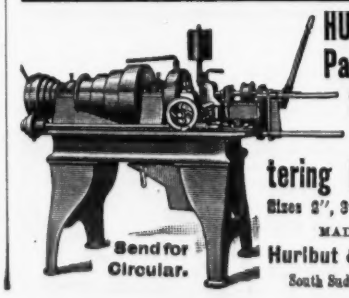

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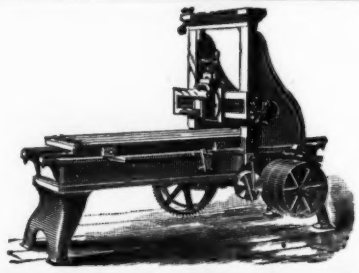

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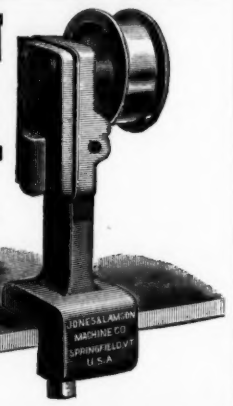

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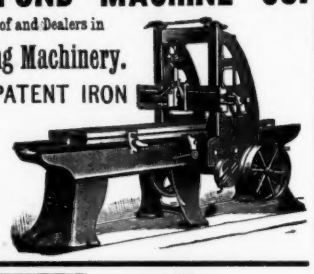

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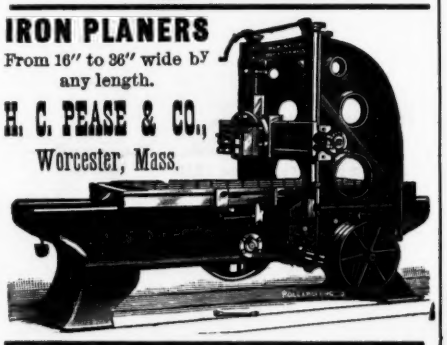

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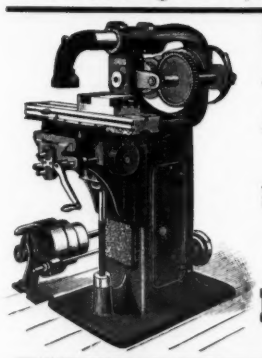

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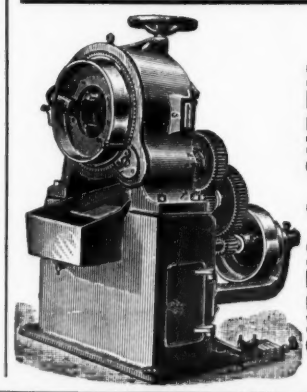

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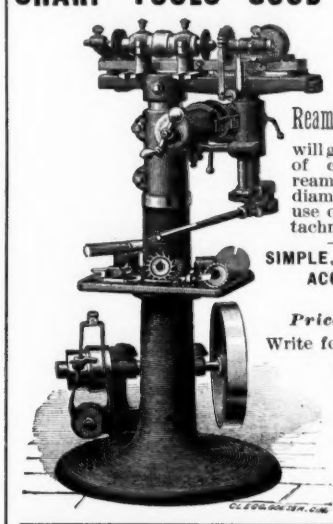

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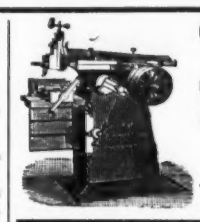

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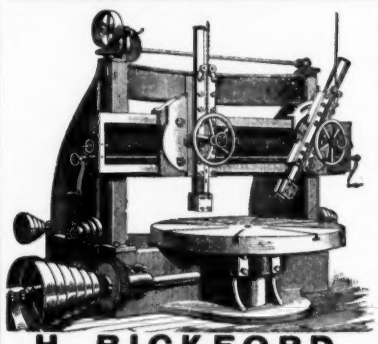

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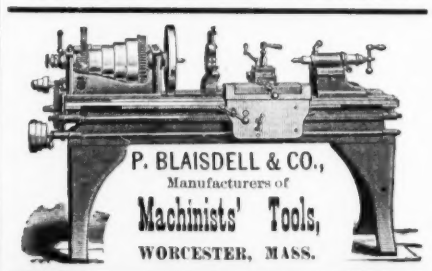

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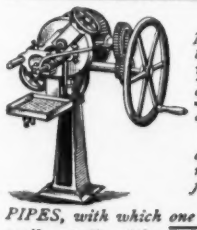

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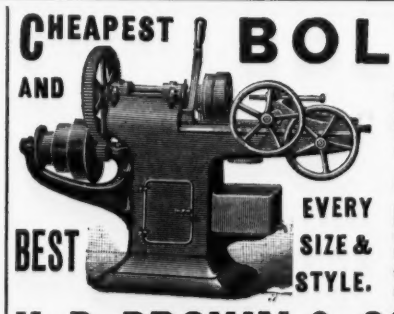

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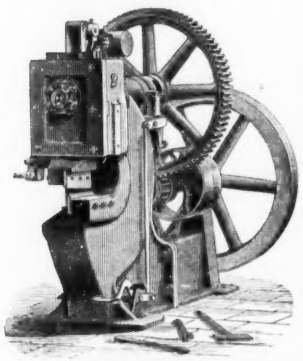
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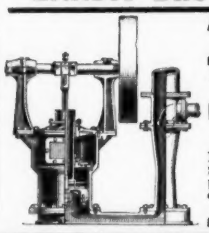
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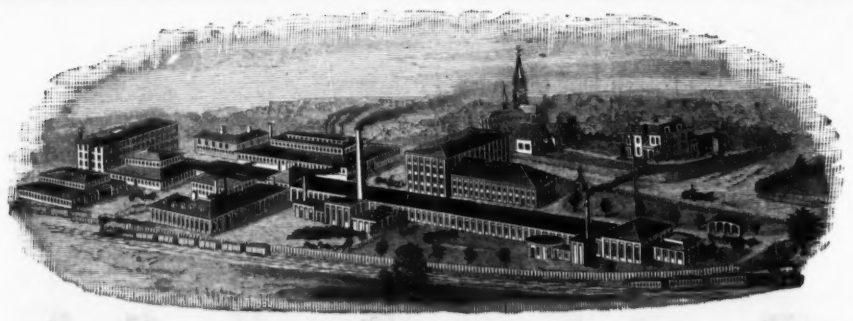
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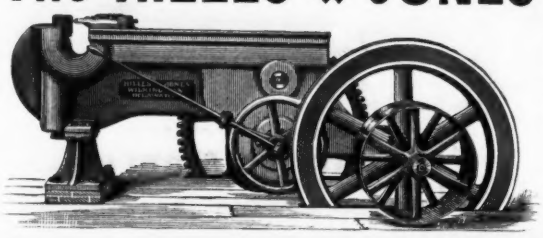
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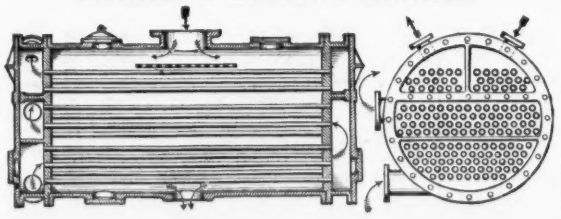
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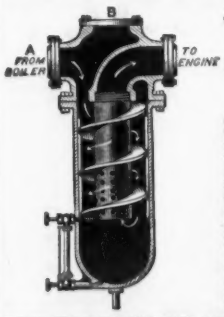

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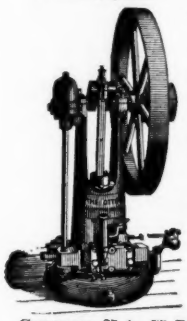

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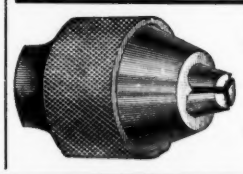

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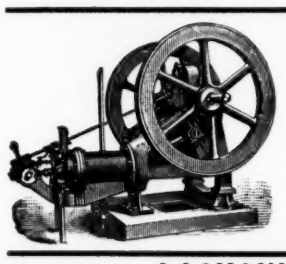

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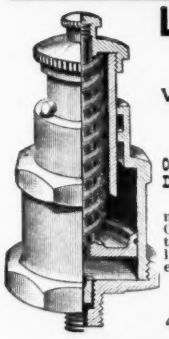

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"	21 in. Back Gears and Wheel Feed	"
"	25-28-32 in. complete.	"
Shaper,	14 in. Trav. Head complete.	Fitchburg.
"	16 24-30 in. stroke,	Eberhardt.

Millers, Universal and Plain. New Styles.
Brass Lathes, Turret and Square Arbor, all sizes.
Turret Machine, 1 in. hole, "New Pattern" Am. Tool Co.
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Combined Punch and Shears 22 in. reach.

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Engine Lathe,	36 in. x 18 ft., modern style,	A1 Putnam.
" "	26 in. swing, 12 ft. bed,	good order.
" "	25 in. " 10 ft. "	fair order.
" "	20 in. " 8 ft. "	good order.
" "	15 in. " 5 ft. "	good order.
" "	13 in. " 6 ft. "	fair order.
Bement Axle Lathe, Regular pattern,		good order.
Planer, 24 in. x 6 ft., Walters,		good order.
"	30 in. x 6 ft., 30 in. x 8 ft., Fitchburg.	good order.
"	42 in. x 42 in. x 12 ft., Fitchburg,	good order
"	48 in. x 45 in. x 11 ft., Burns,	good order.
Shaper, 24 in. Friction, Hendey,		A1.
Drill, 20 in. Pratt & Whitney,		good order.
Screw Machine, Niles Tool Works, 2 in. hole, auto. feed, complete with tools.		good order.
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To drill from 0 to 1-2 inch holes.

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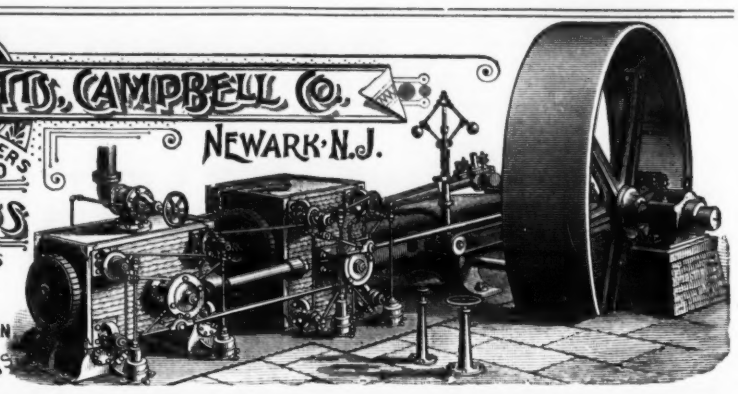

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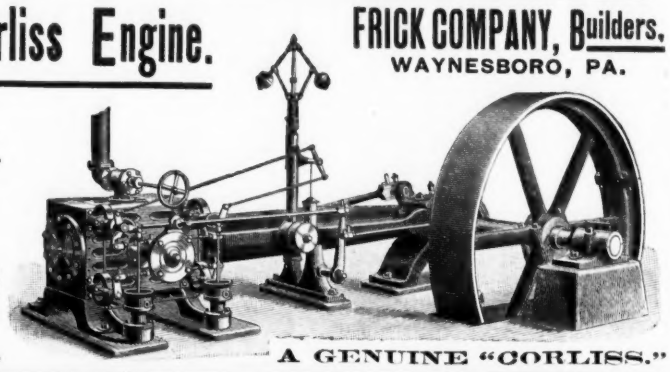

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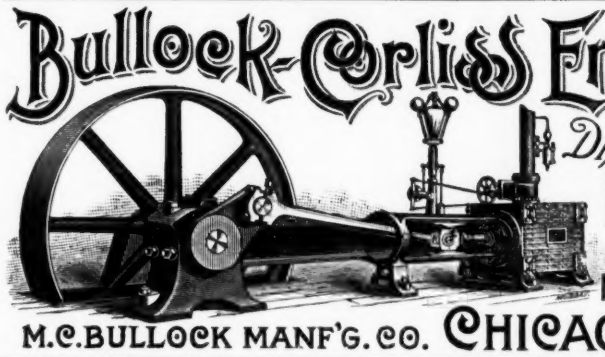

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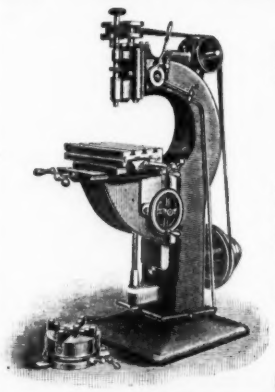

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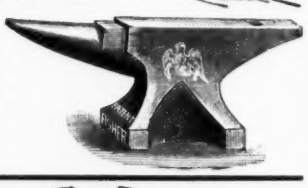

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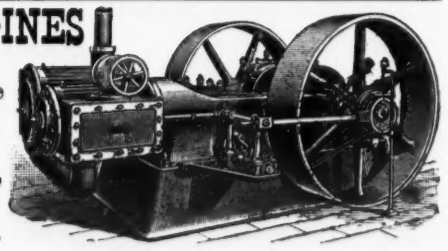

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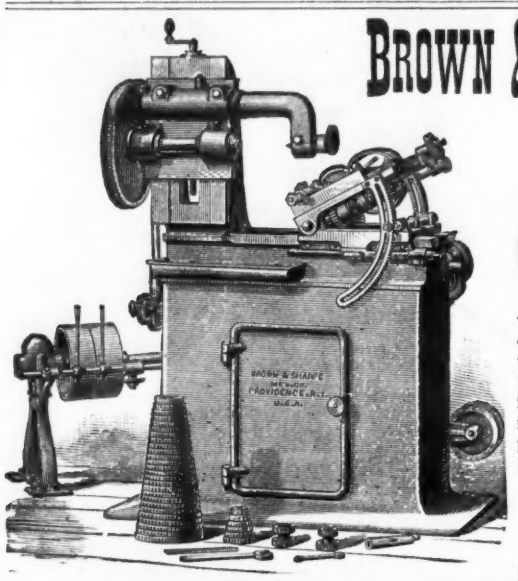

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To plane 16 in. x 16 in. x 3 ft., to 60 in. x 60 in. x 20 ft., with quick return motion.

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With 6 in. x 10 in. stroke.

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1/4	LB.
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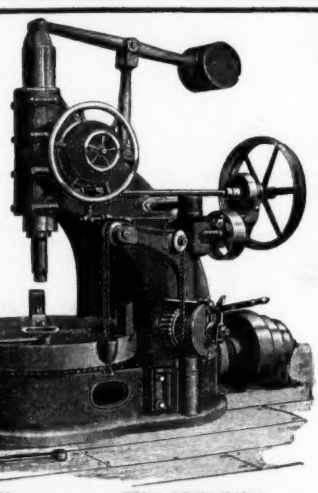

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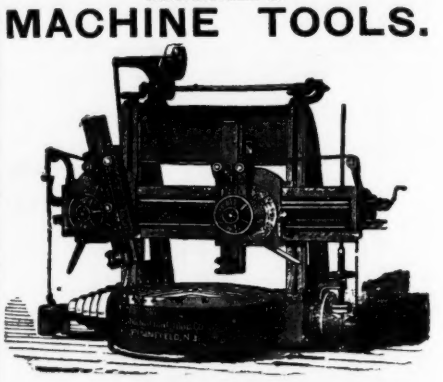

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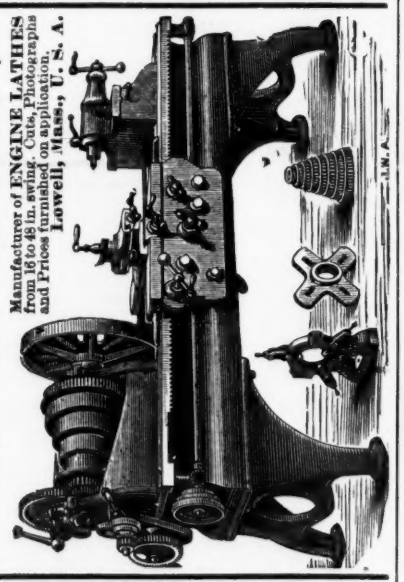

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N. B.—See "Advertisement," page 16.

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A SPECIALTY.
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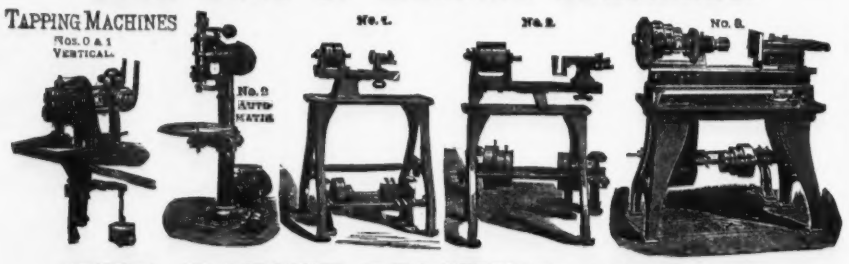

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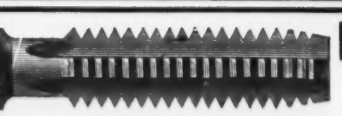

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